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CONTENTS

CONTRIBUTIONS:	PAGE.	GENERAL NEWS:	PAGE
Concerning Railroad Clubs.....	53	Bridge Building.....	68
Westinghouse vs. Buffalo, Rochester & Pittsburgh.....	53	Meetings and Announcements.....	68
ILLUSTRATIONS:		Personals.....	69
The Gas Engine and its Mission.....	53	Elections and Appointments.....	69
The Illinois Central Improvements at Chicago.....	55	Railroad Construction.....	70
A Composite Railroad Map.....	59	Electric Railroad Construction.....	71
Steel Car Construction.....	60	General Railroad News.....	72
The H. K. Porter & Co. 21-Ton Locomotive.....	61	Electric Railroad News.....	72
EDITORIALS:		Traffic.....	72
Steel Car Construction.....	62	MISCELLANEOUS:	
December Accidents.....	62	Technical.....	65
Annual Reports.....	63	The Scrap Heap.....	67
The fight against the Scalpers.....	63	Train Accidents in the United States in December.....	57
EDITORIAL NOTES.....	62, 63	Freight Car Equipment.....	58
GENERAL NEWS:		The Status of the Compound Locomotive.....	59
Locomotive Building.....	68	Massachusetts Railroad Commissioners' Report.....	61
Car Building.....	68	Ohio Railroad Commissioners' Report.....	61
		Buffalo Wheel and Axle Tests.....	65
		Proposed Legislation.....	65

Contributions.

Concerning Railroad Clubs.

TO THE EDITOR OF THE RAILROAD GAZETTE:

One of the railroad clubs, whose membership is made up almost entirely of men from the motive power and car departments, undertook, at a recent meeting, to discuss a subject pertaining to another department. The meeting, as would naturally have been supposed, was uninteresting and unprofitable, because the large majority of the membership were not thoroughly conversant with the subject, and would never be called upon to decide the questions considered, while those from the outside, invited presumably to enlighten the members, were able to give little more than opinions of very questionable value.

It would seem that for meetings of railroad men, almost all of whom are engaged in the same line of work, subjects should be selected in which the majority have more than a passing interest; this, of course, applies to clubs whose members are not from many branches of railroad service and where many branches are not about equally represented. If the supposition is correct that higher railroad officers encourage the railroad clubs for the reason that the exchange of ideas at the meetings is of benefit to the roads, it would seem to be poor policy where a club is composed almost exclusively of one set of men to endanger this good opinion by considering any but the most important subjects directly connected with the work of the members. The Proceedings of the railroad clubs so far this season indicate that some of the older organizations are falling short of their high standard of excellence, while some younger clubs are rapidly improving.

Much of this can be traced directly to the selection of subjects, for no matter how good the paper presented at a club meeting, unless the subject is one regarding which the members are well informed and in which they take a lively interest, the discussion will necessarily be weak; and undoubtedly all agree that the discussion is of more importance than the paper. There are too many unsettled questions in the mechanical departments for those clubs which have heretofore been particularly strong in mechanical discussions to waste time on questions which do not directly concern their members.

M. POWER.

Westinghouse vs. Buffalo, Rochester & Pittsburgh.

PITTSBURGH, PA., Jan. 22, 1898.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of Jan. 21 there appears a statement on the authority of the New York Air Brake Company, denying the correctness of a statement in your issue of Jan. 7, under the heading of "Air Brake, Litigation." That statement was to the effect that in a suit brought by the Westinghouse Air Brake Company against the Buffalo, Rochester & Pittsburgh Railroad Company for using infringing apparatus made by the New York Air Brake Company, "on motion for a preliminary injunction, argued before Judge Cox at Utica, N. Y., Jan. 4, the injunction was granted and the railroad company was allowed four months in which to remove the infringing brakes." The order of the Court reads as follows:

"Ordered, that a preliminary injunction issue out of and under the seal of this Court, restraining the further infringement of the letters patent of the complainant, . . . by the manufacture, use or sale of either of the said inventions or apparatus embodying the same, but the operation of said injunction is suspended so far and

so long as to enable the defendant to comply therewith as follows, viz: "Then follow the provisions that the railroad must remove at least 250 of the infringing brakes within 30 days from date, 250 more within 60 days from date, 250 more within 90 days from date and the balance of all the infringing brakes within 120 days from date; that the suspension of the injunction is only upon the further expressed condition that sworn statements by the railroad company shall be filed with the Clerk of the Court at the end of each succeeding 30 days, showing that the conditions have been complied with; and that, in the event of the failure of the railroad to carry out any of the conditions specified, the suspension of the injunction immediately terminates. The statement of the New York Air Brake Company which you publish is therefore untrue and misleading, and your published statement in your issue of Jan. 4 is correct in every respect.

We may add that, soon after the final decision of our infringement suits against the New York Air Brake Company with reference to this apparatus, we notified the various companies that had purchased the same, and made them a liberal proposition for the removal of the infringing brake apparatus and the substitution of our own. In most cases this proposition was accepted, and a large portion of the infringing New York brake apparatus has since been removed. In a few cases the owners of the infringing apparatus persisted not only in using the same, but also in sending the cars equipped therewith abroad on the lines of railroads that desire to maintain a high standard of air-brake efficiency, and that seriously object to the presence in their trains of other air-brake apparatus in combination with that which they have purchased from us. We have received numerous complaints from railroad companies because they continued to receive cars fitted with the infringing New York brakes, after the courts had apparently placed us in a position where we might insist upon their removal, and we were called upon to protect the railroads from the annoyance and trouble that they were thus experiencing. Although the Buffalo, Rochester & Pittsburgh Railroad Co. accepted our liberal proposition for the removal and replacement of the New York brakes more than two years ago, it wholly failed to fulfill its agreement; and when we learned that it was equipping some new cars with the latest style of New York brake, which is a still more objectionable and inferior apparatus than the earlier forms, we brought suit to compel the removal of the infringing apparatus. We are now preparing, as rapidly as possible, to bring suit against the other owners of the infringing New York brakes who have not already taken steps to remove them.

THE WESTINGHOUSE AIR BRAKE COMPANY,
H. H. WESTINGHOUSE,
General Manager.

The Gas Engine and its Mission.—IV.

BY S. A. REEVE.*

(Continued from page 38.)

THE MISSION.

In spite of the indictment which the writer read against the Otto type of gas engine in the first papers it is obvious, from figures there given, that it is, nevertheless, pushing itself steadily, and of late rapidly, into recognition as a standard and popular prime mover. For this phenomenon there must have been a cause, and a cause powerful enough not only to overcome prejudice and ignorance, but to also overbalance the glaring mechanical defects of the machine. It is in this fact that lies the gist of the situation.

The demand of the day is for power not only cheaply developed but cheaply subdivided and distributed. One might cite a thousand illustrations of the phenomenally rapid growth of large manufacturing establishments, with their many departments, as explanations of this fact. Many other economic causes add their impetus to the movement. The best illustration of all is that of the electrical industries, whose entire growth is due solely to this demand. For we have no natural source of electricity. Every ampere has to be generated before use, from mechanical power already available in the ordinary rotative form. Yet the additional expense of apparatus and the loss of efficiency involved in one or several subsequent transformations of this energy is widely and willingly endured for the sake of merely that facility in transmission and subdivision, which is the chief characteristic of the electrical form of energy.

To this happy faculty of electricity is gradually being added facility in storage. The importance of both faculties—storage and transmission—is further illustrated in the rapid development of the hydraulic and pneumatic systems of transmitting power.

One is forced, then, to the following conclusions, especially if we recall the fact that the plants developing power from a special, cheap gas, which are the only ones as cheap in operation as a steam-plant, constitute a very small minority of all gas-power plants: *That the gas engine has spread in use not because it is efficient, not because it is mechanically attractive, but because its source of power—gas—is a fluid cheaply and conveniently transportable from a central source to a myriad of distant and isolated points of consumption;*

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and further, that the first two arguments—expense and mechanical crudity—have been powerful obstacles in confining the expansive power of the latter argument—transportability—within exceedingly narrow limits. This leads directly to the secondary conclusion, that the demand of the hour in gas-engineery is, first, a gas engine mechanically as docile as the steam engine; and secondly, a more or less generally available supply, in the individual factory or entire community, of a gas as cheap per heat-unit, although not necessarily so weak, as the Dowson or the Lencauchez. It is with the first demand alone that we are concerned here; and as the second is now partially fulfilled the first is also the more important.

To absolutely demonstrate these propositions would require a volume of figures beyond the capacity of these papers. Every man's experience in power development, if reviewed in the light of these propositions, will be found to corroborate them. A few facts may serve as illustrations before turning to a more detailed analysis of them. Thus, as to transportability, the 54 per cent. of the German engines quoted from Schaefer in the first chapter were utilized in departments of large factories already equipped with steam or similar power, and speak eloquently of the comparative facility of gas transmission of power over these more cumbersome forms. But to fully realize the superiority of gas-transmission one must remember that there is no loss during transmission to any distance, however great, except by leakage and in the power necessary to maintain flow. The former in ordinary street-mains is large, to be sure, but chiefly because the velocity of flow is so limited by the nature of the service that the pipes are unduly large and because most of the mains now in use were laid before the importance of keeping down leakage was realized. Even then the leakage averages less than one per cent. per mile.

Under these conditions 1,000 H. P. would call for something less than a 5-in. pipe to transfer the necessary gas at a moderate velocity and about 4 H. P. per mile to keep it in motion. These figures are already much lower than for any other form of power transmission. But if we suppose the gas compressed, an essential condition for the efficient transmission of power in large quantities, to the common working pressure of 80 lbs. per square inch a 2-in. pipe would suffice for the 1,000 H. P., and something less than 1 H. P. per mile would be required to keep it in motion; while at higher pressures these figures become even more insignificant. (The figures are based upon Professor Unwin's experiments with compressed air on a large scale in Paris.) I think it is safe to say that there is no system of power transmission in existence which can approach these conditions for total cost of installation, including terminals, and for operative efficiency, except perhaps the pumping of oil through pipes. In comparison with steam it must also be remembered that gas mains are cold and dry, and require neither covering, drainage nor expansion-joints.

As to facility for storage, although gas is seemingly a bulky commodity, the comparative showing is good. Dr. Schilling, of Munich, is authority for the statement that there is one gas-holder in London capable of storing power enough to light the former city with electricity for a year. If this be true Munich's demand for light is meager; for 12,000,000 cu. ft., the capacity of the holder referred to, would supply for one year only an average of about 2,000 horse-power-hours per day. Nevertheless the statement is striking, and it is obvious that a moderate-sized holder would take the night demand for power, from day to day, for a large city. For taking the peak off the load of a central station there is nothing to compare with it. With compressed gas the figures are still more striking. Thus the Seine gas barge stored about 45 horse power-hours in each steel flask, weighing 715 lbs., a record not to be approached by storage battery or compressed air, either as to weight or cost.

So far we have supported the argument in favor of gas engines on the score of the desirability of gas as a form of fuel for power purposes. On the other side, proving the expense and mechanical disability of the gas engine, two facts will suffice.

First, as to expense, the fuel-cost per horse-power hour has already compared with that of a steam plant of the same cost and conditions of operation as 2 cents for gas, at \$1.20 per M., and 1 cent for steam, with coal at \$4 a ton and 5 lbs. per horse-power-hour. These figures are so chosen as to give every benefit of doubt to the gas engine, and no modification of condition can prevent conclusions in favor of the marked superiority of steam.

As to mechanical defects, it need be only called to mind that every gas company in the country uses power in its works, to drive blowers, exhausters, pumps, etc., and that not one such company, to my knowledge, utilizes, or will consider, a gas engine for this work. Here the expense of operation would be less than with steam, for gas costs much less to make than to deliver. The expense of installation and attendance is much less than with steam. Finally the desire of the gas company to set a good example to possible consumers of gas for power might be assumed to be a cogent argument in favor of their use of gas engines. Yet they will not tolerate the presence of one in the works. Their explanation is that "they want a motor which can be relied upon to do what they want it to when they want it to." Such a motor the steam engine is and the gas engine is not.

The above arguments—superiority of gas over steam for storage, transmission and subdivision, and its

marked inferiority as to the motor itself—coupled with its very low cost when used on a large scale, lead to firm conclusions, which may be stated as follows:

First, the ultimate destiny of the gas engine is inestimably wider than that of the steam engine even, and not to be compared with its present limits; and second, the gas engine which is to fulfill this mission must, as a machine, not be content with an inferior approach to the lowest steam engine standards, but must take a high stand as its peer, or even its superior, in mechanical adaptability, delicacy and docility.

If we consider along what path past advance has been made, we shall find it a very narrow one, and can be

stated tersely as follows: If, in Fig. 2, the curves *ADF* and *GIN* represent, on pressure-volume co-ordinates, two adiabatic hyperbolas, the amount of heat necessarily supplied to transport a working substance from the inner to the outer curve is approximately the same, no matter at what point the transfer be effected; in fact, as far as the processes common in gas engines are concerned, it is nearly independent of the path by which the transfer is made. Therefore, all comparisons of different amounts of work developed between these two curves may be considered as depending upon the supply of a given fixed quantity of heat under all circum-

stances. The two curves have been purposely chosen as far apart as ever occurs in Otto engine practice.

Fig. 2.—Diagram of Comparative Theoretical Indicator Cards of the Lenoir, Otto, Combustion—under-constant-pressure, and Diesel Gas Engines.

If the line *QG* be an atmospheric, the diagram *QAII* *GQ* would be the theoretical indicator diagram of a Hugon or Lenoir engine, the earliest of the commercial types. Here *QA* represents the suction of a charge of gas and air at atmospheric pressure, *AH* its combustion at constant volume, *HG* its expansion, and *GQ* its exhaust.

Similarly the area *ABIIH* would represent the card of the Otto "Silent" engine, the first one working on the De Rochas cycle. Here *QA* represents suction, *AB* compression, *BI* explosion, *IH* expansion, and *HAQ* exhaust (the clearance-volume, which cannot be exhausted, is not represented on this diagram). Thus the De Rochas cycle gained advantage of the area *ABIIH*, which was beyond the reach of the Lenoir, but it burnt its ships behind it in that it forever abandoned the area *AH* *GQ*, which was available for the Lenoir; for in the De Rochas cycle the horizontal length of the lines *AB* and *IH* must always be the same. Expansion can never be carried to a volume greater than that of the original suction-stroke.

The ablest attempt at evasion of this limitation is embodied in the history of Atkinson's futile efforts with his "Differential" and "Cycle" engines, regarding which reference can be had to any gas engine treatise. To-day the limitation is accepted as inevitable, even by Mr. Atkinson.

But there is no apparent obstacle to shifting the line *BI* to the left, as at *CK*, and thus increasing the area of available work to *ACKH*. As a matter of fact the entire history of the development of the engine during the past 20 years has consisted almost solely, according to Mr. Clerk, in the gradual extension of the compression-line *ABC* to higher and higher points, such as *D*. (The one other work of importance has been the more or less complete removal of residual burnt gases from the clearance-space.) The heaviest card I have ever seen is given by the line *DM*, and this surpasses good average practice. According to Clerk, "the gas engine is now rapidly nearing the limit of advantageous increased compression, so that no great further economy is to be expected there."

The obstacles in the way are entirely operative, not theoretical ones. First, while theoretically the greater the temperature range the greater the efficiency, in practice it is found that the higher the upper temperature limit (for the lower one is firmly fixed) the greater is the loss from radiation, etc., both natural and that artificially incurred from water jackets in order to protect the cylinder and piston surfaces. This has already gone so far that the gas-engine cylinder often develops a smaller percentage of its theoretic possibilities than does the steam engine, in spite of the poorer conductivity of its working substance.

Secondly, it has come to be an axiom with steam-engine designers that the value of a given design is generally proportional to the ratio between maximum and mean effective pressures. For weight and cost are nearly proportional to the former; indicated power is exactly proportional to the latter. With steam engines, too, it has been found unprofitable to let this ratio rise higher than four in the most expensive types; three is the common ratio for condensing engines, while two or

more prevails in the broad class of simple non-condensing engines whose supreme commercial value has made them the commonest of all types.

But in the De Rochas gas engine this ratio is always much higher; and this is the simplest possible explanation of why gas engines cost so much more per horse power than do steam engines. Thus, with a maximum pressure of 360 lbs. per square inch in the cylinder this ratio is theoretically 10.6; actually, owing to the maximum pressure being less than the theoretic, it is about 9.

Moreover, as we attempt to increase efficiency by crowding the explosion line to the left in Fig. 2, this ratio increases very rapidly. Thus in raising the final pressure of compression from *C* to *D* the mean effective rises only fractionally as fast as *c* to *d* (and with this fraction steadily decreasing), whereas the maximum rises at the same time from *K* to *M*. It is obvious that the maximum pressure will rise in some geometric ratio to the mean effective, as this process is extended, until the point of absurdity is soon reached. Fig. 3 shows the rise of this ratio with increased compression. The lowest value shown, now long obsolete, is very "high for good steam engine practice." Turning again to Fig. 2, why should not the span from a diabolic to adiabatic be crossed by some other path less awkward mechanically than the vertical one, since the amount of heat involved is practically constant? It is obvious that the path most nearly at right angles with the curves will give the greatest amount of available work for the least range of either pressure or volume, and the two are equally undesirable.

Early in the century Cayley had an engine working on this principle with combustion continuous in a regular coal furnace under the maximum working pressure. Ericsson's "flame engine" was similar in idea. Sir Wm. Siemens is on record as saying before the British Institute of

Civil Engineers that he had great faith in this type, and had built one, but that fate made him choose between this problem and the search for high temperatures in metallurgical furnaces as his life-work. The Brayton petroleum engine in this country operated on this principle, with intermittent combustion within the cylinder. A later engine upon a much larger scale, the *Gardie*, was reported as very successful abroad, although the American attempt was a failure. In it the gas was generated under maximum working pressure, and combustion was intermittent within the cylinder. Two other attempts on the same principle have come to my knowledge through private sources. Finally comes the Diesel motor, which deserves more careful attention.

Mr. Rudolph Diesel started out to approach as nearly as practicable to the Carnot cycle, which consists of (I) adiabatic compression to maximum temperature, (II) isothermal absorption of heat, (III) adiabatic expansion to the original temperature, and (IV) isothermal cooling, as in a condenser. It is the perfect cycle, of maximum possible efficiency.

The steam engine really displays the nearest approach to it in practice; the necessarily low maximum temperature of steam, however, limits its value in these cases. The gas-engine cycle, on the other hand, is a very poor

Fig. 3.—Diagram Showing Increase of Ratio between Maximum and Mean Effective Pressures of the Otto Cycle with Increased Amounts of Pre-compression.

one, because there is great variation in temperature during the supply of heat; but it results efficiently because it has tremendous opportunities due to its high temperatures. Of these opportunities, however, it utilizes, but a small portion.

It was to combine these two—the great opportunity resulting from high temperature, and the full realization of them due to isothermal absorption of heat—that was Mr. Diesel's aim. The latter point was the difficulty.

To surmount it he raises his air by adiabatic compression to the temperature of ignition. Then he injects atomized petroleum in such quantity that the temperature during the ensuing combustion shall rise only slightly, if at all. This combustion is continued, always under excess of air, as long as the demand for power at the instant requires, when the full supply is shut off and adiabatic expansion follows until exhaust takes place. For the details of the machine and the cycle see *Progressive Age* for Dec. 1 and 15, 1897, and Jan. 1 and 15, 1897, where is given a translation from the *Zeitschrift des Vereines Deutscher Ingenieure*. It is also published in pamphlet form by the *Progressive Age* Publishing Company, New York.

The result is most gratifying, in two ways: First, the fuel consumption averages 0.55 to 0.60 lb. of oil per brake horse power per hour, an equivalent of 0.66 to 0.72 lb. of anthracite, and falls to a minimum equivalent of 0.57 lb. of anthracite; secondly, the efficiency is nearly constant at variable load, being actually higher at three quarters than at maximum load—a fact which exactly parallels

steam-engine practice. This success undoubtedly crowns Mr. Diesel with the honor of having taken a decided step in advance of anything heretofore existent in the line of heat-engine efficiency.

Mr. Diesel attributes his success, according to Mr. Bryan Donkin, in *The Engineer*, to (I.) the modification of the Carnot cycle by the substitution of all adiabatic for partly isothermal compression, thus attaining the temperature of ignition by means of a range of compression of only some 48 atmospheres; (II) by isothermal heat-supply (from internal combustion); and (III) by availing himself of the area *HGA* (Fig. 2) by complete expansion, an area not available in the Otto or De Rochas cycle.

Now isothermal combustion or heat-absorption can take place in a working substance only during expansion according to the equation $PV = \text{constant}$, unless there be a physical change of state. Thus, in the formation of steam from water there is isothermal absorption of heat and expansion at constant pressure; but if air, which undergoes no change in specific volume, absorb heat isothermally the expansion takes place under falling pressure, or

$$P = \frac{\text{constant}}{V}$$

In the case at hand, if the volume of the petroleum be neglected, the final specific volume of the products of combustion, (since the fuel is given as containing 14.21 per cent. hydrogen and .66 per cent. of oxygen) will be just 1.142 times the original specific volume of the oxygen entering into combustion. Bringing in the volumes of nitrogen and of the 26 per cent. excess of air reported, we find that the total specific volume after combustion is 2.3 per cent. greater than the specific volume before combustion, or, during isothermal combustion expansion would take place according to the law

$$V = 1.025 \frac{\text{constant}}{P}$$

In Fig. 2, if compression ceased and combustion began at a pressure of 45 atmospheres, at the point *a*, this isothermal combustion would follow the curve *axyzvw*, producing a cycle manifestly poorer, for all mechanical considerations, than the De Rochas.

So Mr. Diesel abandons isothermal combustion, both in theory and practice, and substitutes for it combustion under constant pressure, such as shown by the line *EL*, Fig. 1. But with this alteration and the substitution of adiabatic for isothermal compression, our Carnot cycle has become nothing more than the long-known Joule cycle, operating with internal combustion under constant pressure. So the Carnot cycle might just as well have been never mentioned at all.

The lesson to be learned from all this discussion is that the high efficiency of the Diesel motor is due, not to any close approach to the Carnot cycle, not to any mysterious process of isothermal combustion, but to a simple extension of operations to an unprecedented range of pressures. Thus, referring to Fig. 2, Mr. Diesel has merely raised the pressure under which combustion takes place from our illustrative level of *EL* to that of 45 atmospheres, at *FN*. The theoretic thermodynamic efficiency available at this pressure is 66.3 per cent. As the maximum actual thermodynamic efficiency attained by Mr. Diesel is given as 38.5 per cent., his cylinder efficiency must have been never more than 58.1 per cent., a less than ordinary figure for gas engines.

Therefore, while Mr. Diesel deserves full credit for the working out of the details of construction and operation under such excessive pressures, the moral to be pointed is the very encouraging one that his fuel-rate per horse-power hour is no better, and is even not so good, as that which may be confidently expected from either the Cayley-Buckett, the Siemens, the Brayton, the Gardie, or any other such general type of engines, when once the designer may appear who is willing to undertake the commercial handling of such working pressures as 45 atmospheres, or 647 lbs. per square inch by gage. And the highest pressure reported for Mr. Diesel is 711 lbs.; so that the above statements are inside of the truth.

Finally, before we leave this question of thermodynamic efficiency, it must be pointed out that a heat-engine cycle to be just as efficient as the best known need not involve the use of such high temperatures as are now in practice. And high temperatures, whatever their theoretic significance, undoubtedly always mean heavy incidental losses of heat, expensive construction, and impaired durability. But theoretically, too, there are disadvantages in high temperatures.

$$\text{The general expression for theoretic efficiency, } \frac{\tau_1 - \tau_2}{\tau_1}$$

is approximately true of the steam engine if τ_1 and τ_2 are boiler and condenser temperatures respectively, and also of the De Rochas cycle when τ_1 and τ_2 are the final and initial temperatures respectively of adiabatic compression to the pressure at the instant of ignition. Thus, a steam engine using steam of 100 lbs. gage-pressure, non-condensing, would have a theoretic thermodynamic efficiency of about 14 per cent. A De Rochas engine using air of 89 deg. Fahr. to have the same theoretic efficiency would have to compress only to about 1½ atmospheres. The actual efficiencies of these two engines would be much the same. But the maximum temperature of the former would be about 337 deg. Fahr., while that of the latter would theoretically be about 5,000 deg. Fahr., and would actually be over 2,000 degs. So that higher temperatures do not always mean higher theoretic efficiency; they always do mean greater actual losses.

Again, whatever be the maximum temperature of the cycle the portion of its heat which is available for work depends entirely upon the available ratio of expansion. In other words, if P_1 , V_1 and T_1 represent the condition of the substance just before expansion, the final temperature T_2 depends upon the range of expansion, as limited by P_2 or V_2 as the case may be. If $P V^n = \text{constant}$ be the equation of expansion, the maximum theoretical efficiency, which is expressed by $\frac{T_1 - T_2}{T_1}$ is also given by the expression,

$$1 - \left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}} = 1 - \left(\frac{V_1}{V_2}\right)^{n-1}$$

In short, it is independent of the initial temperature unless unlimited pressure and volume range is available.

This is why the water-jacket of an Otto engine is little hindrance to efficiency; for the volume range is rigidly limited, and if we abolished the water-jacket we should merely make the exhaust hotter.

So far we have discussed heat-efficiency alone. But, to repeat, heat-efficiency is a secondary consideration in attempting to expand gas-engines; and it is only in so far as achievement in this line shall be attended by the needed harmonious solution of the mechanical problem involved that the unquestionable mission of gas engines already pointed out can be fulfilled.

The Illinois Central Improvements at Chicago.

In the *Railroad Gazette* of July 10, 1896, we described the relations of the city of Chicago and the Illinois Central Railroad Company to each other in regard to the Lake Front improvements at Chicago. We now take up the engineering features of this work. The work of track depression and rearrangement in the Illinois Central terminal yards is so intimately related to the work of park improvement that to make a comprehensive summary of either a liberal treatment of both is required.

Briefly, the general plan of the undertaking includes the depression of the Illinois Central yard tracks, the erection of an ample suburban passenger station at Van Buren street, and the coincident filling of the old Lake Front Park to a grade that hides from street view all train movements in the park. In addition to this there is the conversion of the inner harbor into a park extending to the harbor line of 1890, shown in Fig. 1. These features of the work rendered necessary extensive retaining walls, viaducts and bulkheads, which, taken in their entirety, constitute one of the most comprehensive single pieces of railroad engineering that has recently been considered in the United States. The conspicuous location upon the lake shore and in the heart of Chicago lends to the undertaking an interest somewhat greater than that which attaches to ordinary field work.

Depression of the tracks received the especial attention of Mr. David Sloan, Assistant Chief Engineer, and was commenced on April 15, 1896. The work, in charge of Mr. H. U. Wallace, then Resident Engineer for the Illinois Central at Chicago, was completed Oct. 1, 1896. The average depth of the depression is about 4 ft. About 14 miles of track was laid, with 136 switches and 10 crossings. The volume of earth removed, 100,366 cu. yds., was filled upon submerged land of the railroad company. The old tracks were poorly arranged, and much valuable space was saved by a careful rearrangement. Some transposition of tracks was also necessitated by the close relation of viaduct supports in the right of way. These features of the yard have received a careful treatment in the general redistribution of tracks that has taken place, and the yard is now a model. We expect to publish a description of the tracks in a future issue.

Bulkhead Work.

The sea-wall or bulkhead work was contracted to H. B. Herr & Co., of Chicago, early in the fall of 1895. In November of that year, in conformity with plans and conditions furnished by the United States government through Major W. L. Marshall, of the Government Engineering Corps, operations were begun. Three marine pile drivers and as many steam dredges were employed in placing the piles and filling the bulkheads as driven. The work was completed about Oct. 1, 1896. As shown in Fig. 1, there are now driven and filled approximately 7,400 lin. ft. of sea wall, minus two 100-ft. temporary openings left for the entrance of lake craft of the lighter sort, and for the ultimate purpose of filling, by scows, the enclosed area to the depth where surface filling may be resorted to with profit. No appropriation for this work (east of right of way) has as yet been made by the city. The South Park Commissioners now control the Lake Front Park. With the exception of some filling at random from scows loaded with dredgings from the Chicago River, and some miscellaneous matter contributed from the street cleaning and building departments of the city, no filling has been done on the submerged tract. Filling may be done by trains from the drainage channel at approximately 25 cents per cubic yard, or by sand sucker dredges, set in the outer harbor, for about 16 cents. per cubic yard.

The choice for practical operation in making this enormous fill lies between the two courses named, with one other source of supply open. This would be the sand dunes along the lake shore, southeast of the city. The cost of delivery in the latter resort would be about the same as that for drainage channel material. By contract with the Brownell Improvement Company, of Chicago, the old Lake Park was filled, by cars brought over the St. Charles Air Line from the

drainage channel to the extent of 200,000 cu. yds., with blue clay and a top soil of 100,000 cu. yds. of material that will better sustain the verdure which has been added by the South Park Commission.

the existent conditions would seem to justify it, a fourth wale at the mid-depth of the water occupied is also placed as before described, and shown in Fig. 3 A. Wakefield triple-lap sheet piling is driven within the

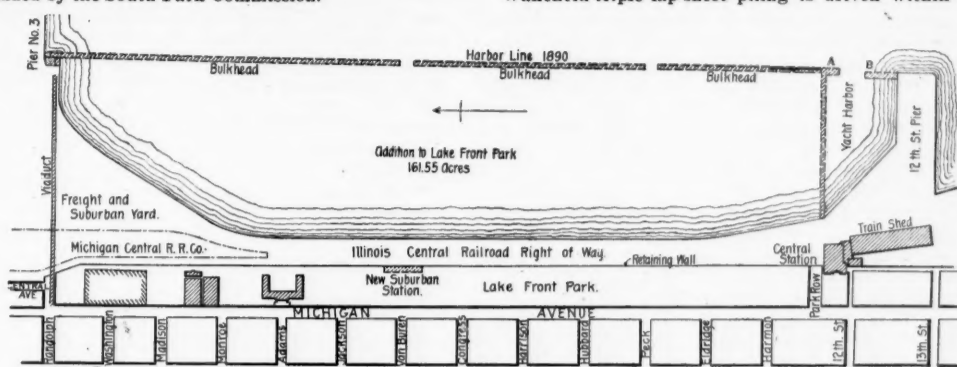


Fig. 1.—Chicago Lake Front, Randolph Street to Thirteenth Street.

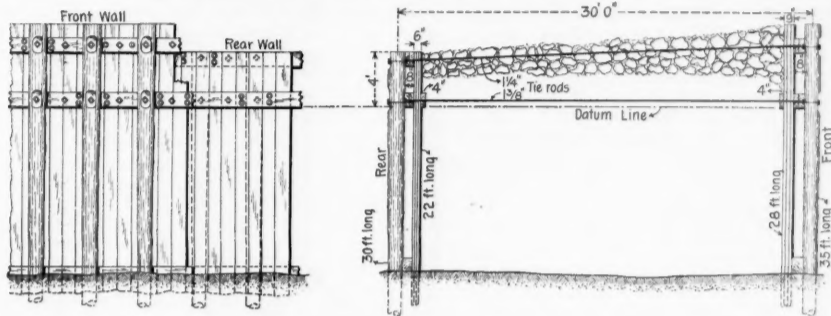


Fig. 3.—Elevation and Cross-Section of Bulkhead.

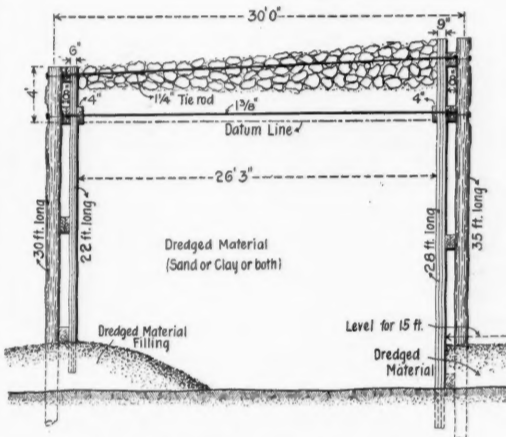


Fig. 3a.—Bulkhead for Water over 16 Ft. Deep.

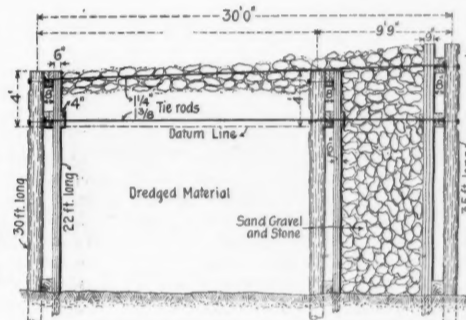


Fig. 3b.—South End of Bulkhead.

The park (west of the railroad) has, during the season of 1897, been terraced in two levels between Michigan avenue and the line of the west retaining wall at the railroad tracks, and a fine sod grown upon it. Shrubberies have also been liberally set out, and the commanding equestrian statue of John A. Logan, recently placed upon an eminence at the line of Eldredge Court, completes the welcome transformation.

The general design of bulkhead employed is that shown in Fig. 3, front and rear elevations and cross section. Two parallel lines of white oak or Norway pine piles 1 ft. in diameter are set at intervals of 4 ft., longitudinally, and 30 ft. in cross section, with a vertical length of 35 ft. in the seaward side and 30 ft. in the rear wall. These piles are driven to a depth in the sea row of 29 ft. below city datum, with a 6-ft. projection above datum; in the rear row to a depth of 26 ft. below datum, with a projection of 4 ft. above datum, so that a line drawn from front to rear and from cap to cap of the series of piles will describe a fall of 2 ft. to landward. Upon the inner faces of these piles there are fastened by a 1 1/4-in. bolt passed through each pile, an upper and a lower wale of two 4 in. x 12 in. oak planks laid in, double thickness, butt-jointed with 6-ft. lap, in lengths of 20 ft. The top of the lower wale is placed at 1 ft. above Chicago City datum. Each round pile is flattened at bolt entries upon the sea face to receive a plate washer 3 1/2 in. x 3 1/2 in. x 1/4 in. All bolt ends are riveted up behind the nut, the bolt head being placed to seaward.

To give further stability to the grounding of the round piling an oak mud sill or free bottom wale is pushed down into the earth inside the pile line, as deep as the nature of the soundings may warrant. Where

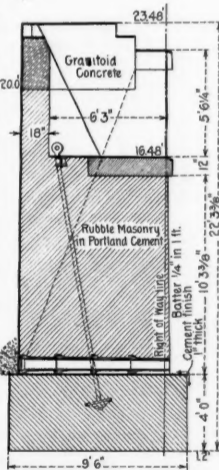


Fig. 5.—Section of Abutment.

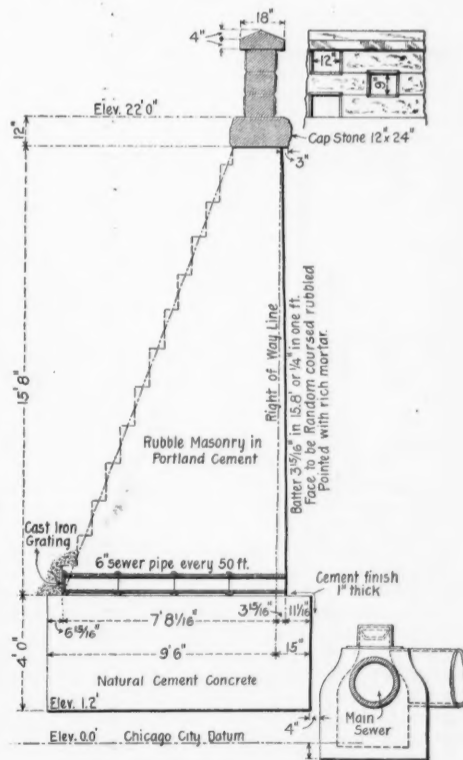


Fig. 4.—Cross Section of Retaining Wall.

ILLINOIS CENTRAL IMPROVEMENT AT CHICAGO.

line of these wales to a depth of 22 ft. at front and 18 ft. at rear, below city datum. A section of this piling is made up of three oak or yellow pine planks, 10 in. wide by 3 in. thick, bound together by 3/4-in. carriage bolts and 1/2-in. wrought-iron boat spikes. This planking is so dis

posed as to form in section a heavy "plowed and grooved" timber with a 3-in. tongue. This sheet piling is 9 in. thick upon the seaward side and 6 in. thick on the back wall. An additional wale 4 in. x 12 in. is placed as shown inside of the sheet piling. Through this sheeting and the wales described there are placed 1-in. wrought-iron bolts, with plate washers, in vertical pairs at 2 ft. longitudinal centers and 4 ft. apart as series of four. This serves to bind together securely the pile, wale and sheet-piling of the separate walls.

Passing through the wales and sheeting at intervals of 4 ft. throughout the length of bulkheads are tie-rods 1 1/4 in. in diameter in the lower wale and 1 1/2 in. in the upper wale, bearing each two wrought-iron plate washers 4 1/2 x 4 1/2 x 1/2 in., so furnishing the transverse or cross support necessary to give the required fixity of the whole. Diagonal tie-rods at 45 deg. to the common line further support the end sections. This form of construction is varied somewhat where exceptional conditions obtain, as, for instance, along certain portions of the sea wall where the depth of water exceeds 16 ft. (Fig. 3-A), and at the south 400 ft. of the bulkhead, where the termination of the government breakwater renders the storm exposure greater. Here it became necessary to construct a double bulkhead, stone filled in the front chamber, as shown in Fig. 3-B. The bulkhead in consuming the average depth of water in the present inner harbor to be 15 ft., which is a conservative estimate, the water area being 161.55 acres, there will be required over seven million cubic yards of filling to bring the outer park up to the desired grade. It is not likely that the wall will be built until the filling is done. A complementary retaining wall bounding the right of way upon the west, from Randolph street to Park Row, has already been built. The old park is now graded to the line established from the rubble line of this wall to the curb height of Michigan avenue, 21 ft. and 15 ft. respectively, above city datum. The park was turned over to the South Park Commissioners early in 1897, and is not now subject to control of the city department of public works.

The retaining walls, features of which are shown in Fig. 4, are built of "one man" limestone rubble, laid in Portland cement mortar, mixed in the proportion of 3 to 1 sharp sand and cement, upon a concrete base 9 ft. 6 in. wide by 4 ft. deep. The base is composed of Louisville cement, crushed limestone and sand, one, two and five. The masonry, at the full depression of tracks, is 8 ft. thick at base, 15.8 ft. high, and 1.75 ft. wide at top, with a batter of 1/4 in. to the foot on the face and 5 ft. 11 1/2 in. batter in the whole height, at the back. Six-inch sewer pipe, laid through the wall at intervals of 50 ft., provides against any accumulation of water at the base of the wall.

The wall is capped by a rock-faced Berea sandstone coping, 2 ft. wide x 1 ft. thick with a 1 in. x 3 in. front wash and marginal chisel drafts of 1 in. top and bottom on the face side. Upon this coping is built a block-spaced stone parapet also of rock-faced Berea, laid up in manner and dimensions shown in Fig. 4. This parapet terminates at either side of viaducts and at wall ends in

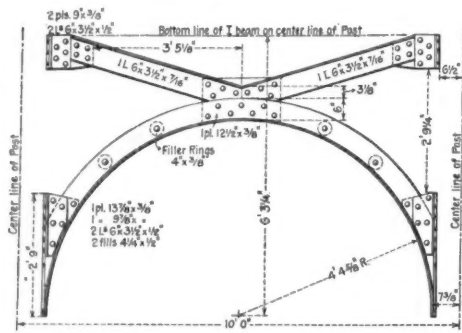


Fig. 11.—Transverse Bracing.

a Berea post, rock faced with marginal drafts and pyramidal cap.

The west wall, 5,800 ft. long, including four abutments, contains approximately 15,000 cu. yds. of rubble, aside from the coping and parapet work. It cost about \$120,000. Where the tracks begin to rise from grade of full depression at either end of the cut, the base of the retaining walls describes a corresponding change of elevation and width; the top of the wall remaining at a constant level.

The J. L. Fulton Co., of Chicago, has the contract entire for building all the retaining walls. All masonry of retaining walls and viaducts was laid under supervision of Mr. R. F. Hoffman.

Viaducts.

From wall to wall, spanning the right of way at three points, between Lake Park Place and Randolph street, overhead bridges have been built, in compliance with the city ordinance authorizing the improvement of the Lake Front Park. This work was designed and directed

by Mr. H. W. Parkhurst, Engineer of Bridges and Buildings. Abutments, as shown in section, Fig. 5, are built as part of the retaining walls, at the extensions of Peck Court, Harrison and Monroe streets, and at the east end of the Van Buren street viaduct. The west end of the viaduct at Van Buren street is supported by columns that stand within and are a part of the suburban station at this point. The street passes over the station's top and is received upon a granitoid bridge seat that forms the top of the recession main retaining wall which here accommodates itself to the 50 ft. x 300 ft. station site. The east abutments will form part of the east retaining wall at its completion. The Monroe street viaduct is yet to be built.

The general character of the viaduct construction

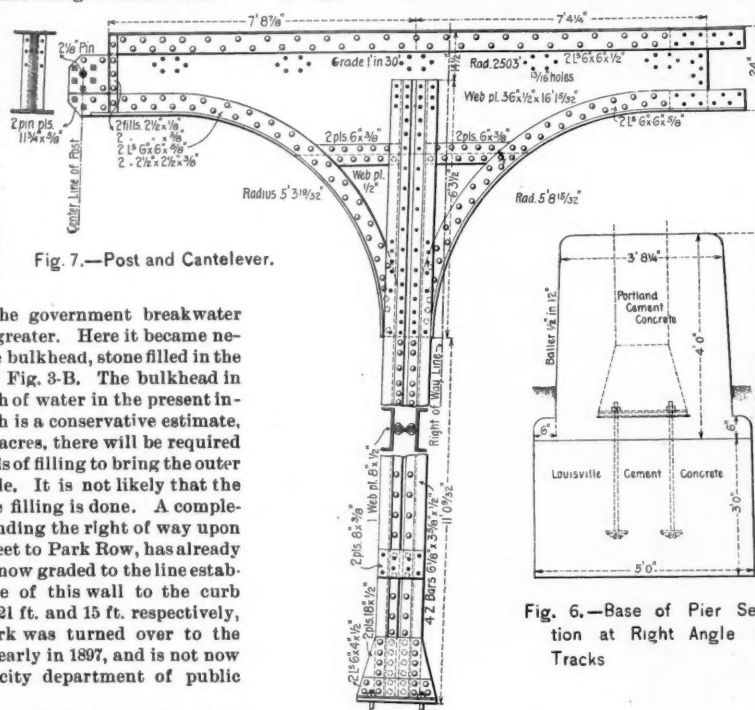


Fig. 7.—Post and Cantilever.

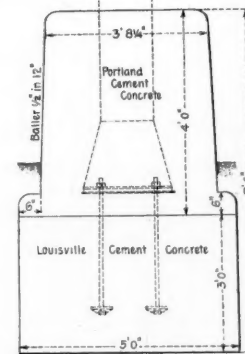


Fig. 6.—Base of Pier Section at Right Angle to Tracks

bedded with the foot of the metal column in the final upper pier work, as shown in Fig. 6. This top course is of Portland cement concrete, 4 ft. wide at bottom, 3 ft. 8 in. at top, 4 ft. high, neat cement finish, with corners rounded to a radius of 3 in. The piers are made continuous between tracks to the full width of the viaduct with the idea of distributing the load over a greater surface, and fending away from the base of the viaduct supports any car that may run off the track. The superstructure is of medium open-hearth steel. The rivets are of soft steel, 3/4 in. and 1/2 in. in diameter. The total weight of the steel superstructure of the viaducts at Peck court and Harrison street is 203 tons each, or about 1 ton per lineal foot of structure. The Van Buren steel structure weighs 280 tons; somewhat heavier than the

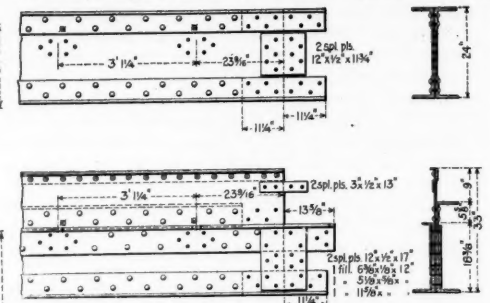


Fig. 10.—Standard and Special Girders.

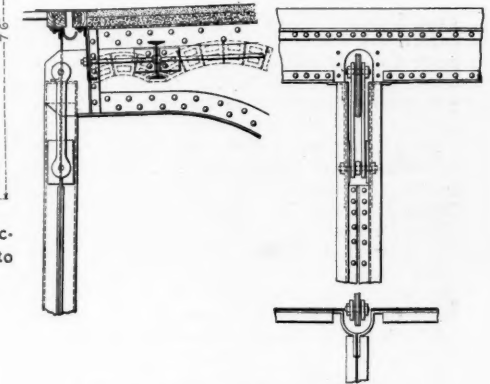


Fig. 9.—Expansion Swing over Station.

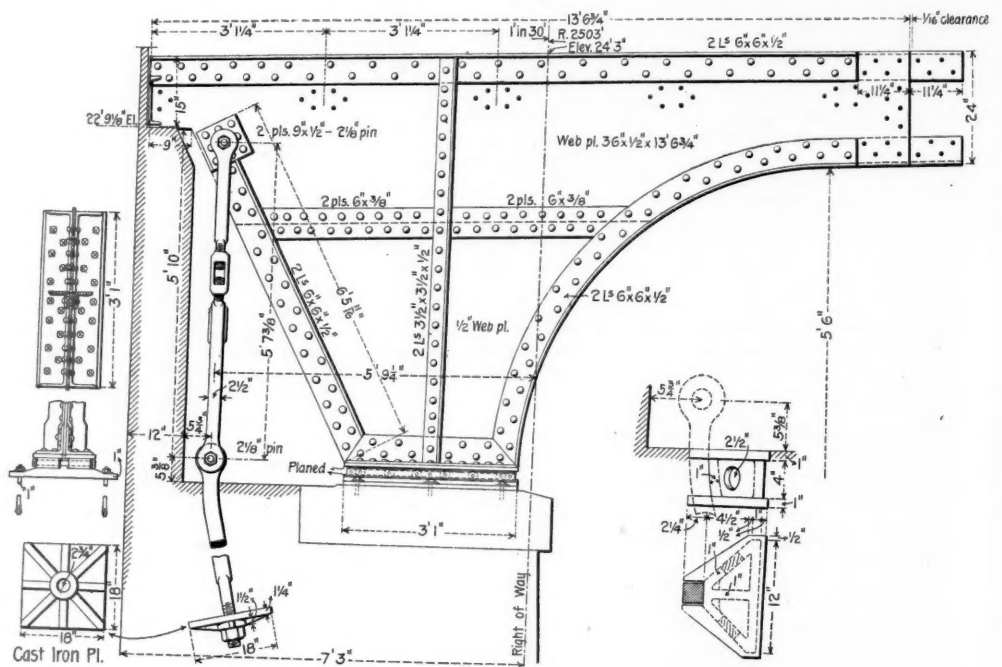


Fig. 8.—End Cantilever and Stool.

may be denominated as a modified type of cantilever work.

In the intervening distance, 200 ft., between abutments, there are four piers for each viaduct, except that of Monroe street, which may require an additional span. These piers are set at a base elevation of 1.5 ft. and 1.17 ft. above datum for first and second piers, respectively, the elevations corresponding with the crowning of the right of way for drainage. Short spans are employed, because of restrictions imposed by the city as to total height, and by track conditions as to head-room.

The figures given are for bridges that span the full depression of tracks. The piers are built solid, parallel to the tracks, 57 ft. long. The base course is of Louisville cement concrete, 5 ft. x 3 ft., with a 6-in. capping course of Portland cement concrete. Anchored in the base to a depth of 2 ft. 5 in. are six groups of four 1-in. round bolts bearing cast-iron washers at their heads. These bolts, retaining the columns in position, are wholly em-

others by reason of its spanning the station's additional width of 50 ft., and having a greater breadth.

The suspended portions of the viaducts are formed of parallel girders with solid rolled I-beam cross-sections at intervals of 3 ft. 1 1/4 in. No distinctive cross girders are used. Five spans of 40 ft. 4 1/4 in. are sustained by four rows of columns, and the abutment at either end. The top surface of the longitudinal girders is built to conform to a curved line described by a radius of 2,503 ft. Longitudinal girders have 3/8-in. camber. The columns are set at 10 ft. centers in cross section, in all instances but that of Van Buren street, where 10 ft. is added to the pier lengths, and the columns are spaced five at 9 ft. and two at 12 ft., to accommodate the additional width of the viaduct at this street.

Fig. 7 will serve to illustrate the construction of the columns, other dimensions being adapted to different elevations. Four "Z" bars 6 1/2 in. x 3 1/2 in. x 1/4 in. are assembled upon a central web plate 8 in. x 1/4 in., forming in section a double channelled post with the

free edges turned outward. At a point 3 ft. above the base plate there are riveted, at opposite sides of the column, upon the common plane of the "Z" bar flats, two plates $14\frac{1}{2}$ in. \times 8 in. \times $\frac{3}{8}$ in. to oppose torsional or bending strain and to add rigidity. The base of the column is composed of two plates 2 ft. wide at bottom, $13\frac{1}{2}$ in. at top, 18 in. high by $\frac{1}{2}$ in. thick. Two L's 6 in. \times 4 in. \times $\frac{1}{2}$ in. \times 20 in. and a base plate 2 ft. square by $\frac{3}{8}$ in. thick. The central web upon which the column bars are combined is omitted from the upper 6 ft. 3 in. of the column's height. The resultant slit receives the main web of the cantilever or spread-top which is there inserted and field riveted. The cantilevers at column points are, with variations of height, length and radius of web consistent with the several positions in the general arc, made up as follows: The body material is in two sections. A solid web plate 16 ft. $1\frac{1}{2}$ in. \times 36 in. \times $\frac{1}{2}$ in. which forms the upper portion of the spread, is butt-spliced to the lower section with four $\frac{3}{8}$ in. \times 6 in. plates riveted across the web. Upon the lower edges the web is cut to upward curves from radii of 5 ft. $3\frac{1}{2}$ in. and 5 ft. $8\frac{1}{2}$ in. respectively. Its edges are bound upon these lines by two L's 6 in. \times 6 in. \times $\frac{3}{8}$ in., the L's being so disposed at the ends of cantilevers as to permit of a $22\frac{1}{2}$ in. lap being made over the ends of L's and central web with $\frac{1}{8}$ -in. clearance at joint. At the top edge there are two L's 6 in. \times 6 in. \times $1\frac{1}{2}$ in., curved with the web to an arc that has a versed sine of 2 ft. at the center of 200 ft.

End cantilevers, Fig. 8, are similarly constructed as to finish of edges and splicing of the body plates. Two L's $3\frac{1}{2}$ in. \times $3\frac{1}{2}$ in. \times $\frac{1}{2}$ in., 7 ft. 2 in. long are riveted upon opposite sides of the main web, upon a vertical line from the center of the stool, as stiffeners. At front the con-

in. square \times $\frac{1}{2}$ in. thick which are flat riveted upon the web and of suitable bore at their center.

This is the standard expansion feature of the viaducts and pertains to all except the west end of the Van Buren street viaduct, before referred to. Here the conditions engendered by the overarching of the suburban station rendered it necessary to devise other equipment. The conditions were met by the application of the parts shown in Fig. 9. A modification of the standard middle cantilever is substituted for the regulation end cantilever. Columns in the first row within the station proper are provided with a semi-circular hollow top. Within this top, at a depth of 2 ft., are affixed to the column steel plates 1 ft. \times $7\frac{1}{2}$ in. \times $\frac{1}{2}$ in., punched at their centers to pass a $2\frac{1}{2}$ -in. pin. A similar opening of $2\frac{1}{2}$ in. is made in the overhanging cantilever end (see Fig. 7), and the two are connected by $2\frac{1}{2}$ in. \times $\frac{1}{2}$ in. bars with solid forged eye ends. The pins form the double fulcrum upon which the metal travel is accommodated. A space of 2 in. is allowed for variations of length due to temperature; this slot being carried up through the bridge parapet. The resultant opening in the floor of the viaduct is covered with a 15 in. steel lap plate, fastened to the viaduct approach over the station's top and retained in position by countersunk screwheads playing in slotted holes in the bridge edge of the plate. A metallic trough beneath provides for all moisture or sediment that may fall through from above.

A standard longitudinal girder, of which a section and part elevation is shown in Fig. 10, is built of a web plate 25 ft. $7\frac{1}{2}$ in. long, 24 in. deep by $\frac{1}{2}$ in. thick. Flush with the edge of the web at top are riveted two 6 in. \times 6 in. \times $\frac{1}{2}$ in. L's 27 ft. 6 in. and 23 ft. 9 in. long upon its respective sides, the difference in length accommodating the $22\frac{1}{2}$ -in. splice lap at the ends. The edging L's at bottom of the girder are increased in thickness to $\frac{3}{4}$ in. Two splice plates 12 in. \times $\frac{3}{4}$ in. \times $11\frac{1}{2}$ in. at either end of the girder complete the union with the other members. The camber is $\frac{3}{8}$ in., and the radius that of the common curve of the structure, 2,305 ft.

The girders used in the side

ordinary neat cement finish. Sidewalks on Van Buren street viaduct are 11 ft. 6 in. clear; roadway, 36 ft. All other viaducts are 9 ft. 6 in. on sidewalks and 30 ft. clear in roadways. The roadways have a crown of 4 in., the apex of crown being 3 in. below sidewalk line.

The entire surface of the structural steel of viaducts is covered with terracotta and fireproofing, as shown in Fig. 12. Stained terracotta, giving much the effect of dressed granite, is used upon the outer portions, and plain tile upon the inner columns and girders. The terracotta is laid with gas-tight joints of cement, as a protection to the steel against fuel gases from passing locomotives, and is also supported by $\frac{1}{4}$ -in. square tie-rods that are hooked upon a $1\frac{1}{2}$ -in. \times $\frac{3}{8}$ -in. iron strap, which is bolted upon the sides of girders and cantilevers.

A stone parapet corresponding to that placed upon the retaining walls forms the finished upper work of the viaducts. It is laid upon a Berea base 18 in. wide \times 9 in. high, which has a double top wash of 3 in. \times 1 in., marginal chisel drafts of 1 in., and sides crandaled. This base also forms a cope of terra cotta work. At each column point a post 18 in. \times 20 in. \times 2 ft. 4 in., rock faced, with 3-in. marginal drafts, is set in the line of the parapet, upon a plinth 24 in. \times 26 in. \times 9 in., with corners rounded and top edges wash cut. A cap 24 in. \times 26 in. \times 9 in. completes the post, which is drilled to pass an electric conduit through the center, each post bearing an incandescent lantern. The whole effect, as shown in Fig. 12-A, is firm and graceful.

The features of the structural steel work are symmetry, economy of weight, and compact strength. The ruling feature of the design is the direct transmission of load stress to the points of resistance, and a studied avoidance of oblique transference or bending strain upon vertical supports.

[TO BE CONTINUED.]

Train Accidents in the United States in December.

COLLISIONS.

REAR.

3rd, on Chicago, Indianapolis & Louisville, near Cloverdale, Ind., a freight train which had been stopped on account of the temporary disablement of the engine, was run into at the rear by a following freight, drawn by two engines. One of the enginemen jumped off and was badly injured. It is said that the flagman of the foremost train failed to go back far enough.



Fig. 12.—Protected Piers—Van Buren Street Bridge

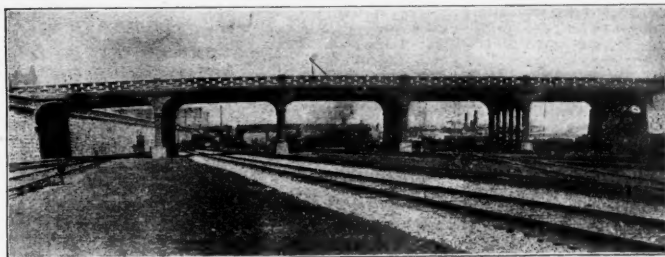


Fig. 12a.—Van Buren Street Bridge.

formation is to an upward curve, radius 5 ft. 6 in. At back it is a line drawn from the heel of the web to a point 3 ft. back of and 5 ft. $4\frac{1}{2}$ in. above it. The base of the end cantilever is prepared for contact with the stool by the addition of two 6 in. \times 6 in. L's to the sides of the main web at bottom. To these L's is riveted a steel sole plate, planed, $13\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 3 ft. 1 in.; twenty $\frac{1}{2}$ -in. rivets forming the tie. A nest of six turned steel rollers $2\frac{1}{2}$ in. diameter, 1 ft. $\frac{1}{4}$ in. from shoulder to shoulder with $\frac{1}{2}$ in., turned, shoulder ends $\frac{1}{2}$ in. long, is framed in two flat bars $1\frac{1}{2}$ in. \times $\frac{1}{2}$ in. \times 3 ft., that are tied from side to side by three $\frac{3}{4}$ -in. rods equally spaced in the length of the side bars. This nest of rollers is laid upon a cast-iron base plate 3 ft. 1 in. \times 23 in. The base plate is 2 in. thick in that portion of the body which sustains the immediate contact of the rollers and is beveled off to meet a thickness of 1 in. along its edges where, by six 1-in. feather anchor bolts, it is bound upon a $\frac{3}{8}$ -in. rust or lead joint to the coping of the abutment. Upon the top of this plate and parallel to the axis of the structure there is a raised tongue $1\frac{1}{2}$ in. \times $\frac{1}{8}$ in., which, accommodating itself to a corresponding groove turned in the body of the rollers at their middle, prevents departure from alignment in the expansive movement.

Each system of cantilevers and longitudinal girders has its separate anchorage in the several abutments. A 2-in. square, iron bolt 14 ft. long, with a welded eye for $2\frac{1}{2}$ -in. pin at top, is anchored with an 18-in. radial ribbed cast plate at a depth of 2 ft. in the concrete base of the abutments, and is built into the masonry to the eye. A thread cut upon the lower end of the bolt permits the placing of the plate, which is secured by a suitable nut. The bolts are set at an angle of about 20 deg. to the vertical; the pitch being opposed to the vertical pull exerted upon the anchorages by the loading of the viaduct. A V-shaped cast-iron block, 6 in. deep, whose recessed point receives the body of the anchor bolt, is built into the masonry of the abutment, in front of and below the eye of the bolt, to provide an enduring contact piece at the point of erosion, if any movement should here develop. These parts are shown in Fig. 8. The anchorage is completed by the application of twin turnbuckle rods, $1\frac{1}{2}$ in. square, with welded eyes, that accommodate the $2\frac{1}{2}$ -in. pins which pass through the anchor bolt and the upper heel of the end cantilever. The point of contact in the cantilever web is fortified with two steel plates 9

spans of the viaducts, and which support the sidewalks, are built up to the additional height required for the footways, as shown also in Fig. 10. The body of the girder is a solid web plate 25 ft. $7\frac{1}{2}$ in. long \times $32\frac{1}{2}$ in. deep \times $\frac{1}{2}$ in. thick. Upon this are assembled one L $3\frac{1}{2}$ in. \times $2\frac{1}{2}$ in. \times $\frac{3}{8}$ in., 25 ft. $7\frac{1}{2}$ in. long; one L 6 in. \times 6 in. \times $\frac{1}{2}$ in., 23 ft. 9 in. long; one L 7 in. \times $3\frac{1}{2}$ in. \times $\frac{1}{2}$ in., 27 ft. 11 in. long, and 2 L's 6 in. \times 6 in. \times $\frac{3}{8}$ in., at the bottom of the girder as binders, with four splice plates and three fillers, the several parts being disposed as shown in the figure.

The regular type of transverse bracing is half arc, half maltese, combined, with the V shape uppermost, as shown in Fig. 11. Two L's placed back to back, 6 in. \times 6 in. \times $\frac{1}{2}$ in., are turned from a radius of 4 ft. $4\frac{1}{2}$ in. to curve upward. The crown of the arc is met by the sheared ends of the two L's, 6 in. \times $3\frac{1}{2}$ in. \times $\frac{3}{4}$ in., 4 ft. $1\frac{1}{2}$ in. long. These L's have a downward deflection of $13\frac{1}{2}$ in. from a right line drawn across their outward ends. Assemblage is made at this point upon a tie-plate $12\frac{1}{2}$ in. \times $\frac{3}{8}$ in. \times 1 ft. 9 in., with 15 rivets. Contact with the column is made at the upper ends of the brace by means of two plates and four L's, as shown; at bottom points four plates, L's and fillers, disposed as shown in the figure, are employed. Four filler rings, 4 in. \times $\frac{3}{8}$ in., are inserted between the backs of the arc L's to afford rigidity.

A cast-iron bracket piece riveted upon the inner side of the columns receives and further supports the lower ends of the crossbrace. The wider braces used in the 12-ft. spacing of the Van Buren street viaduct are similar in construction, excepting that to accomplish the greater reach without employing too great an arc, the under half of the brace is given the form of ellipse, conforming to the radii employed at either extreme. The roadway and sidewalks of the viaducts are of concrete and asphalt. The intervals between the I-beams that connect longitudinal girders are sprung with arches of fireproof tiling laid in Portland cement fattened with lime mortar. Upon this tiling, limestone concrete (Portland) is laid to average 8 in. deep, in the roadway, and is finished with 2 in. of asphaltic concrete and a neat coat of 1 in. of pure Trinidad asphalt rolled under five tons pressure until no longer capable of receiving impression. The sidewalks are of Portland granitoid 5 in. thick upon a 2-in. concrete bottom, and have the

8th, 4 a. m., on Philadelphia, Wilmington & Baltimore, at Elkton, Md., a freight train ran into the rear of a preceding freight, derailing 13 cars and badly damaging the engine. The engineman was injured.

9th, 7 a. m., on Manhattan Elevated, on Second Avenue Line, at 103d street, New York City, a passenger train ran into the rear of a preceding passenger train, breaking many windows and damaging the locomotive. Both trains were well loaded and 2 passengers and one fireman were injured. There was a dense fog at the time.

10th, 5 a. m., on Chicago, Milwaukee & St. Paul, at Pine River, Wis., a freight train descending grade broke in two and the front portion being very quickly stopped by the automatic application of the air brakes the rear portion ran into it wrecking 3 cars and damaging a bridge. Two passengers and the conductor, all of whom were in the caboose, were considerably injured.

12th, 7 a. m., on Lehigh Valley, in the Vosburg tunnel, near Wilkes Barre, Pa., a freight train which had been stopped on account of a delay to a train ahead of it was run into by a following freight train drawn by two engines, damaging both the engines and several cars of coal; the foremost of the two engines was overturned and six cars were derailed in the tunnel, many of them being thrown crosswise of the track. One car was burned up and the tunnel was not cleared of the wreck until late the next day. The collision occurred about 2,000 ft. from the end of the tunnel and the wreck almost immediately took fire. All the men on the train succeeded in getting out of the tunnel, though they had to crawl on their hands and knees in order to avoid suffocation by the smoke. One man was badly bruised, but there were no other bodily injuries. Fire engines were sent for but they did not reach the tunnel for some time and the fire was not put out until 5 o'clock in the evening. It is said that the engineman of the colliding train deliberately passed an automatic block signal at the entrance of the tunnel which indicated danger, on the assumption that the signal was out of order, that signal having been out of order for two or three days previously.

13th, on Norfolk & Western, near Marion, Va., freight train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking several cars. A carload of oil took fire and a part of the wreck was burned up. A tramp was fatally injured.

15th, on Philadelphia & Reading, near Excelsior, Pa., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, damaging 15 cars. One trainman was injured.

16th, on Missouri Pacific, near Fort Smith, Ark., a passenger train which had been stopped on account of a hot box, was run into at the rear by a following freight train and the rear passenger car was wrecked. One passenger was killed and 4 injured. It is said that the foremost train depended upon torpedoes to stop the freight and that these failed to explode.

18th, 2 a. m., on Central of New Jersey, at Westfield, N. J., a freight train standing at the station was run

into at the rear by a following freight, making a considerable wreck. The wreck took fire and 15 cars were destroyed. One trainman was injured. It appears that the flagman did not go back far enough.

18th, 3 a. m., on Union Pacific, at Medicine Bow, Wyo., a passenger train ran into the rear of a preceding freight, damaging the caboose and two freight cars. An employee riding the caboose was injured.

18th, 3 a. m., on Delaware & Hudson Canal road, near Sidney, N. Y., a passenger train ran over a misplaced switch and into a platform car standing on a siding. The engine was overturned and the first 2 cars were badly damaged. The fireman was fatally injured and the engineman less seriously.

18th, on New York, Chicago & St. Louis, at Ashtabula, O., a freight train ran into the rear of a preceding freight and the engine and 2 cars were wrecked. The wreck took fire, but the fire, after some time, was extinguished.

20th, on Ohio Southern, at South Charleston, O., a passenger train ran into the rear of a preceding freight train, wrecking the caboose and one freight car, which took fire and were burned up. Three trainmen were injured.

20th, 6 p. m., on Pennsylvania Railroad, at Altoona, Pa., a freight train consisting of an engine and 43 loaded cars which had become uncontrollable on the descending grade from Gallitzin, ran into the rear of a preceding freight in front of the passenger station and the engine and about 50 cars were wrecked, many of them being totally destroyed. Forty of them were loaded. A part of the wreck fell to the right, wrecking 5 cars standing on a side track, and a part fell to the left, wrecking 4 empty passenger cars, and part of a west-bound freight which came along just at that moment. The engineman and fireman of the runaway train were buried in the wreck, but escaped with comparatively slight injuries. A driver and 2 brakemen were killed and 3 tramps riding on the freight were injured. The runaway freight became uncontrollable soon after it passed over the summit at Gallitzin, and it traversed the 11 miles of crooked railroad to Altoona in about 16 minutes. On 11 of the cars at the forward end of the train air-brakes were in use, and the engineman seems to have fully utilized the air-power, but the momentum of the train was too great to be thus overcome. The failure of the trainmen to control the train by hand brakes immediately after passing the summit is explained by the slipperiness of the rails, and of the tops of the cars and the brake wheels. Rain had been falling all day and it froze to the cars and to the rails. The summit is in a tunnel and it is customary to wait until out of that before applying hand brakes. The crew was composed of experienced men but the tops of the cars were so slippery that it was very difficult and dangerous to crawl from one car to another.

21st, on Chicago & Eastern Illinois, at Cayuga, Ind., a passenger train ran into the rear of a preceding freight, which was standing on the side track; the engineman and a man learning the road were killed and the fireman and an air-brake inspector were injured.

22d, on Terminal Railroad, at St. Louis, Mo., a switching engine ran into the rear of a preceding stock train on the Mississippi River bridge, damaging the caboose and one car of hogs. Two employees were injured.

24th, 2 a. m., on Union Pacific, at Grainger, Wyo., an empty train waiting near a watertank was run into at the rear by a following passenger train, badly damaging both engines. One engineman was injured.

26th, on Kansas City, Fort Scott & Memphis, at Liberal, Mo., a freight train descending a grade broke in two and the rear portion afterward ran into the forward one, wrecking several cars. Three passengers and two trainmen were injured.

27th, on Chicago & Northwestern, at Fond du Lac, Wis., a passenger train ran over a misplaced switch and into some freight cars standing on a side track, damaging several cars. Three trainmen and two passengers were injured.

And 32 others on 25 roads, involving 6 passenger and 42 freight and other trains.

BUTTING.

2d, on Chicago, Indianapolis & Louisville, near McCordsburg, Ind., butting collision between a south-bound passenger and a northbound freight train, making a bad wreck. The engineman of the passenger train was injured.

2d, on Great Northern, at Barnesville, Minn., a switching engine pushing two cars up a steep grade to a coal track was allowed to run too fast and the cars fell off the end of the track, which was on a trestle. The coupling broke just as the last car fell over, and the engine, which had been reversed and deserted, ran back down the incline and out upon the main track. It ran two miles at high speed and then met a passenger train. Both engines were badly damaged and 2 men who jumped off were seriously hurt.

3d, on Erie & Pittsburgh, at Erie, Pa., butting collision of freight trains, one of the engines being overturned. The engineman and fireman were injured, the former probably fatally.

7th, on Chicago, Indianapolis & Louisville, near Frankfort, Ind., butting collision between a work train and a local freight train, the former being insufficiently protected by flag. The work train was standing on a trestle, and both engines and 5 cars fell through to the creek below. Five employees on the freight train were injured.

11th, on Chicago, Indianapolis & Louisville, at Bloomington, Ind., collision between a passenger train and a stock train, wrecking several freight cars. Two passengers, a driver and a passenger engineman were injured.

12th, 7 p. m., on Chicago & Alton, near East St. Louis, Ill., butting collision of freight trains, wrecking 8 cars. One engineman and two other trainmen were injured.

14th, on Pittsburgh, Cincinnati, Chicago & St. Louis, near Royal Center, Ind., butting collision between a passenger train and a freight, derailing both engines and 4 freight cars. A tramp stealing a ride was killed and 2 passengers and one tramp were injured.

16th, on Chicago & Eastern Illinois, near Clinton, Ind., butting collision between Southbound passenger train No. 3 and Northbound freight, wrecking both engines and 2 baggage and 10 freight cars. Both enginemen and both firemen were killed and 4 other trainmen were injured. It is said that the freight men "forgot about the express."

19th, on Chicago & Alton, at Pontiac, Ill., an express train ran over a misplaced switch and into the head of a freight train standing on a side track, making a bad wreck. Three trainmen, 2 passengers and a tramp were injured.

19th, 7 p. m., on Denver & Rio Grande, near Castle Rock, Col., a chair car belonging to a work train and occupied by 70 employees of the roadway department broke away from its train and ran two miles down grade, met a southbound freight train, and was completely wrecked. Thirty-six of the occupants were injured. Many of the injuries were comparatively slight,

though the car was running 35 miles an hour when it struck the engine of the freight. The report in the Denver Republican says: About 6:30 o'clock the gang boarded the chair car, waiting for the freight train, which was to take it to Salida, to be made up. The car was switched back and forth several times in the yards opposite to the depot. Presently the car started toward Denver and the men inside thought the train had been made up and that they were on their way to Salida. Consequently they paid no attention to the rapid way the car ran. The truth was that the coupling pin connecting it with the car ahead of it snapped as the freight train gave a sudden jerk forward. The men, all unconscious of their perilous condition, chatted and laughed with one another and did not realize the situation until after they crawled out of the wreck. The freight train was soon backed down after the runaway but was too late to overtake it.

20th, 6 a. m., on Philadelphia & Reading, at East Mahanoy, Pa., butting collision between freight trains 86 and 89, badly damaging both engines. The collision occurred in a tunnel and the trainmen came near being suffocated by the gases from the disabled engines.

20th, on Southern Pacific, near Benson, Ariz., butting collision between an empty engine and a freight train drawn by two engines, wrecking 3 engines and several freight cars. One engineman was killed.

21th, on Detroit, Toledo & Milwaukee, near Wilderville, Mich., butting collision between a westbound passenger and an eastbound freight train, wrecking both engines, one baggage car and several freight cars. Five trainmen were injured. It is said that the freight train disregarded a meeting order.

23d, on Great Northern, near Kalispell, Mont., a freight train on a descending grade became uncontrollable, was deserted by all of the crew, and collided while running at high speed with a snow plow moving in the opposite direction. Both engines, the plow and 17 loaded freight cars were wrecked. The engineman, before deserting his engine, pulled the whistle open and fastened it, thus giving a continuous alarm. The alarm was heard by the men in charge of the snow plow, and they could possibly have saved their train by running it upon a side track, but they knew that a passenger train was following on behind them, and so they stopped their train, saved themselves, and left the plow and engine to stop the runaway and prevent a collision with the passenger train. No person was hurt.

24th, 11 p. m., on Norfolk & Western, at Clark's Summit, Tenn., butting collision between a passenger train and a freight, badly damaging both engines, 2 baggage cars and several freight cars. A postal clerk was killed and 3 other trainmen were injured, two of them fatally. It is said that the engineman of the freight mistook a figure 3 for an 8 in a telegraphic order, and thus encroached about five minutes on the time of the passenger train.

And 9 others on 9 roads, involving 1 passenger train and 17 freight and other trains.

CROSSING AND MISCELLANEOUS.

1st, 8 p. m., on Illinois Central, at Memphis, Tenn., a passenger train ran into a switching engine; 1 passenger injured.

4th, 10 p. m., on Atchison, Topeka & Santa Fe, at South Denver, Col., collision of locomotives, injuring 1 engineman and 1 fireman.

14th, on Lake Erie & Western, at St. Mary's, O., a freight train was backed into the rear of a passenger train standing at the station and one passenger car was badly damaged. One passenger was injured.

15th, on Lehigh Valley, at Sayre, Pa., a passenger train ran over a misplaced switch and collided with a string of cabooses standing on the side track. The fireman and a man sleeping in one of the cabooses were injured.

17th, on Chicago & Alton, at Joliet, Ill., collision between a passenger train and a switching engine, damaging both engines and one mail car. One engineman was injured.

18th, on Columbus, Sandusky & Hocking, near Shawnee, O., a freight train was run into at the rear by a following empty engine, doing slight damage. The empty engine, having been reversed and abandoned, ran back some distance to Drakes, where it was run off the track by the derailing switch at the Toledo & Ohio Central crossing.

20th, 7 p. m., on Delaware, Lackawanna & Western, at Secaucus, N. J., collision between a passenger train and a switching engine, badly damaging one tender. Two passengers and 2 brakemen were injured.

21st, on Philadelphia & Reading, at East Mahanoy Junction, Pa., a freight train just backing out of a side track, preparing to follow a passenger train, was run into by an empty engine and both engines and several cars were wrecked.

23d, at Ogden, Utah, collision between a passenger train of the Oregon Short Line and a switching engine of the Southern Pacific: one employee injured. It is said that both trains approached a crossing at a rate of speed faster than the regulations allowed.

24th, on Central of New Jersey, at Jersey City, N. J., a switching engine ran into some freight cars, doing slight damage. One brakeman was killed and two other trainmen were injured.

24th, on Lehigh Valley, near Hazleton, Pa., collision between a passenger train and an empty engine; conductor and one passenger injured.

27th, 8 p. m., on Philadelphia & Reading, at Shippensburg, Pa., a car of a freight train which was being switched on the main track became uncontrollable and ran some distance down-grade toward the station; an empty passenger train moving backwards collided with it, making a bad wreck. The passenger conductor was killed and 4 trainmen were injured. A brakeman was on the runaway car, but it appears that the brake chain was broken.

28th, on Wabash road, at Palos, Ill., collision of passenger train, one of which was entering a side track, damaging one passenger car; several passengers were injured.

29th, on Philadelphia & Reading, at Linfield, Pa., collision between a switching freight and an empty engine; three employees injured.

29th, on Boston & Maine, at Bondville, Mass., collision of freight trains, one of which was entering a side track; one employee injured.

31st, on Philadelphia & Reading, at Philadelphia, Pa., a switching engine ran into a coal car which was being pushed out of a side track and fouled the main line just as the switching engine approached. Five men pushing the coal car, from whom the approaching engine was hidden, were injured, 2 of them fatally.

And 17 others on 17 roads, involving 5 passenger and 22 freight and other trains.

DERAILMENTS.

DEFECTS OF ROADWAY.

3d, on Great Northern, near Dunham, Mont., a passenger train drawn by two engines was derailed by a broken rail and both engines were overturned. One en-

gineman was killed and the other engineman and both firemen were injured.

And 7 others on 7 roads, involving 4 passenger and 3 freight trains.

DEFECTS OF EQUIPMENT.

1st, on Pittsburgh & Western, near Cleveland, O., 11 cars of a freight train were derailed by a fallen brake beam. A part of the cars ran upon a bridge spanning a street below the track and, with the bridge, were wrecked.

13th, on Missouri, Kansas & Texas, near Sealy, Tex., a freight train was derailed by a broken wheel and six cars of wheat fell into the ditch. Two tramps were injured.

And 13 others on 11 roads, involving 13 freight and other trains.

NEGLECT IN OPERATING.

12th, on Atchison, Topeka & Santa Fe, at Antelope Gap, Tex., a freight train was derailed by a misplaced switch and 5 cars were wrecked; 3 trainmen injured.

16th, 5 a. m., on Chicago, Indianapolis & Louisville, near Lafayette, Ind., a car in a freight train was derailed by a stone which fell off the end of a platform car ahead of it, and 18 cars were wrecked. A part of the cars fell off a bridge and damaged that structure to some extent. One brakeman was injured.

16th, 7 p. m., on Pennsylvania Lines, at Columbia City, Ind., an eastbound freight train ran through an open derailing switch, and the engine and tender were overturned. The engineman jumped off and was injured.

17th, on Manhattan Elevated, at 147th street and Eighth avenue, New York City, a passenger train ran over a misplaced switch and into a crossover track; the speed of the train was too great for a sharp curve and the engine and first car were derailed.

18th, 6 a. m., on Chicago & Northwestern, at Vail, Ia., a sack of mail thrown out of the mail car of a fast passenger train struck and broke a switchstand and thereby opened the switch sufficiently to derail all the cars in the train behind the mail car, all of which were overturned. The train was running at high speed and there were about 80 passengers in the cars, but only 18 were injured and none of those very seriously. The weather was very cold at the time.

24th, on Duluth, Misabe & Northern, at Hibbing, Minn., several cars in a mixed train were derailed and 3 passengers were slightly injured. Four freight cars and the passenger car were ditched and the passenger car was partly overturned, but did not take fire. It is said that the derailment was caused by logs falling off a flat car in the forward part of the train; one of them struck a switchstand and seems to have caused the loosening of the switch rails.

And 4 others on 4 roads, involving 2 passenger and 2 freight trains.

UNFORESEEN OBSTRUCTIONS.

1st, on New Orleans & Northwestern, near Rayville, La., a passenger train was derailed by a plank which had dropped from a wagon and lodged on the track at a highway crossing; engineman and fireman injured.

And 8 others on 8 roads, involving 2 passenger and 6 freight trains.

UNEXPLAINED.

2d, on Central of New Jersey, at Elizabeth, N. J., the engine of a passenger train was derailed and overturned while passing over the interlocking switches at the junction of the New York & Long Branch Railroad.

10th, on Nevada California-Oregon, near Reno, Nev., a mixed train was derailed and several cars fell down a bank. One passenger was injured.

12th, on Southern Pacific, near Gilroy, Cal., a passenger train drawn by a locomotive which was running tender first was derailed and the engine overturned. The fireman was injured.

16th, on Baltimore & Ohio Southwestern, at Iuka, Ill., the engine and first 4 cars of a passenger train were derailed and the engineman and fireman were injured.

19th, on Terminal Railroad of St. Louis, near Merchants' Bridge, St. Louis, Mo., the engine of a freight train was derailed and fell down a bank. The fireman was killed and the engineman and conductor were injured.

19th, on Cincinnati, Portsmouth & Virginia, near Batavia, O., the engine and 9 cars of a freight train were derailed on a trestle and fell to the ravine below. The engineman and fireman were injured.

21st, on Cleveland, Cincinnati, Chicago & St. Louis, near Coal Bluff, Ind., a freight train was derailed and nine cars were ditched. A tramp, riding in one of the cars, was killed and four others were injured.

23d, on Louisville, Evansville & St. Louis, near East St. Louis, Ill., a freight engine was derailed and overturned and the conductor and fireman were injured.

28th, on Chicago, Hammond & Western, near La Grange, Ill., a train consisting of an engine and a caboose was derailed and fell off a bridge into Salt Creek, 3 ft. deep. Six trainmen were injured.

And 44 others on 36 roads, involving 6 passenger and 39 freight and other trains.

OTHER ACCIDENTS.

2d, on Chicago & Alton, at Higbee, Mo., the cab of a locomotive was wrecked by a coal chute which fell down in front of it just as the engine approached. The engineman, the fireman and a tramp were injured.

3d, 1 a. m., on Chicago & Erie, at Westminster, O., the locomotive of a freight train was wrecked by the explosion of its boiler and the engineman, fireman and one brakeman were injured.

4th, on Union Pacific, near La Salle, Col., the engine of a passenger train was badly damaged by the breaking of a siderod, and the engineman was injured.

29th, on Philadelphia, Wilmington & Baltimore, near Philadelphia, Pa., the cab of the locomotive of a passenger train was wrecked by the load of a derrick, standing near the track, which was swung in front of the engine as the train approached. The fireman was injured.

And 2 others on 2 roads, involving 1 passenger train and 1 freight.

A summary will be found on another page.

Freight Car Equipment.

The following extracts are taken from a discussion of the subject, "Freight Car Equipment," at the December meeting of the St. Louis Railway Club.

MR. A. G. STEINBRENNER (Master Car Builder, American Refrigerator Transit Co.): Within 20 years or more the average freight cars have been increased threefold. For many years—say from 1855 to 1876—the standard

capacity of freight cars was from 20,000 to 24,000 lbs. About 1879, the principal Eastern and Western trunk lines commenced to construct cars to carry 40,000 lbs.; about 1883, 50,000 lb. capacity cars made their appearance; then 1889 the 60,000-lb. car came into existence, which was considered the standard. But within the past years some few roads have added 80,000 and 100,000-lb. ore and coal cars to their equipment.

The reason for the steady increase in car capacity is apparent from the fact that freight classifications make no distinctions in the minimum carload weights between large and small cars. But the increase in car capacity has been exclusively in those carrying light and bulky freight. This increase has made the necessity for economy in transportation in the direction of moving a given quantity with the smallest number of cars and trains.

It seems from a careful study to be hardly probable that any further advantage can be gained in the construction of wooden cars of greater carrying capacity than 70,000 pounds, owing to the necessarily increased size and strength of the parts, which will add greatly to the dead weight and decrease the proportion of the paying load. These developments must undoubtedly cease from the increased use of metal in car construction, by which it may be possible to further increase the paying load and decrease the percentage of dead weight.

Taking the freight traffic of the country as a whole, about 30 per cent. of the total tonnage is of such character that a full carload does not reach the limit of weight capacity, while 70 per cent. is such that may be loaded beyond the full capacity of the car. This is caused by the light and bulky freight being carried in covered cars and the difficulty to get a full carload of this material.

Box cars, including refrigerator and furniture cars, are about 47 per cent., open cars about 43 per cent. and stock cars about five per cent. of the total freight equip-

the roads and the community that a limit shall be set upon car capacity, and in my opinion that is impossible with the carload unit.

Given a rate based on the ton, with a minimum number of tons, the same rate to be given for an unlimited number of tons, it will not then be a question of the ordering of carloads, but of the ordering of equipment for the transportation of a certain number of tons, and that will equalize the conditions, as it will then be possible for every road to make the same rate on the same tonnage, which, it is well known, is not possible with the carload unit.

So, to my mind, the increased capacity of freight cars is dependent upon the rate unit. If the present method of basing rates is to be continued, the limit of capacity is only dependent upon the limit of skill of our engineering and mechanical departments.

MR. C. B. ADAMS (Car Service Agent, Wabash R. R.): The following figures bearing on this subject may be interesting; at least they will show the economy of large-capacity cars:

Year.	Weight of car.	Weight of load.	Total.	Load per cent. of total.
1873.....	20,500	20,000	40,500	49.38
1879.....	27,000	40,000	67,000	64.52
1893.....	29,000	60,000	89,000	67.53

A Composite Railroad Map.

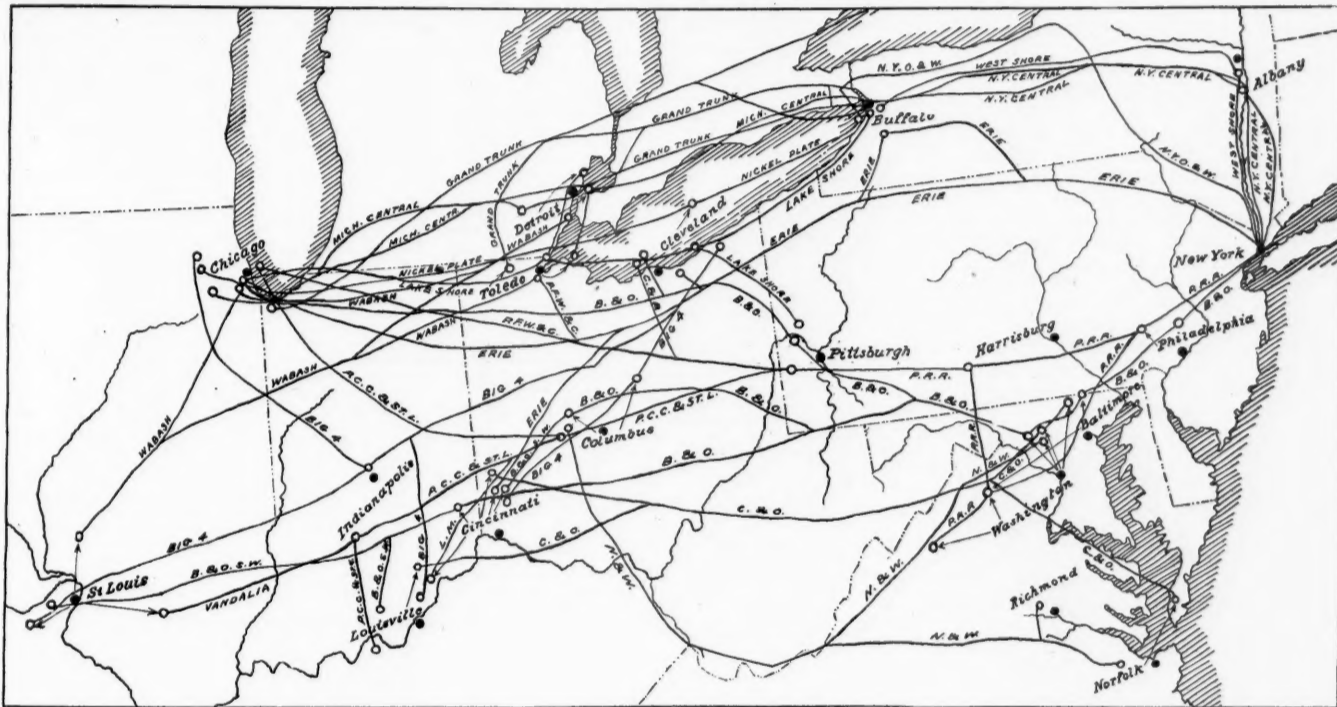
The engraving shown herewith has been prepared to illustrate some of the peculiarities of the advertising maps issued by the principal railroads in the territory between the Atlantic Ocean and Chicago and St. Louis. Its nature will be understood by reference to the solid dots, indicating the true location of the principal cities, and comparing them with the circles, of the same circumference, near by, which show the locations in which the same cities are placed on the maps of the several

are apt to do more harm than good. The writer knows of one town on a leading trunk line, in the school-house of which hangs the map of this great railroad line. This is the only map there of the state whose name the road bears, and yet its lines are distorted in a seemingly purposeless way. If a pupil should compare this with a true map he would probably form a very unfavorable opinion of either the intelligence or the honesty of the railroad officers. The writer also recalls one Christmas eve, when, snowbound at a crossing in Northern Indiana, he with a number of other travelers, tramped in a snowstorm to a town which according to the map of the snow-bound road, the only accessible guide, should have been only two or three miles away, yet when Christmas morning dawned upon the tired travelers, who had found shelter at a farm house, there still lay 10 miles between them and their objective point.

"A map is nothing more nor less than a graphical summary of distances and directions. Why should it not then be as accurate as the figures it represents? The inconvenience it may cause to shippers or travelers seems certainly to be worth consideration. Would it not be practicable to adopt the true geographical maps as a basis, and trace upon it the various railroad lines connecting cities and towns? Each company could make its own route appear in heavier lines, as is done now, yet the true geographical situation would be maintained. Railroad maps would then have an enhanced value, beyond that of attracting such customers as never look at other than railroad maps."

The Status of the Compound Locomotive.

The status of the compound locomotive was the subject of a discussion at the December meeting of the St. Louis Railway Club, from which the following extracts are taken:



Composite Map of Trunk Lines in Joint Traffic Association Territory.

ment of this country. The average loads of the covered cars are lighter than those of the open cars. However, these covered cars are not exclusively confined to light and bulky freight, but often receive heavy loads.

The tendency in the future will be toward metal construction in cars of increased capacity, concentrating the tonnage in fewer cars and shorter trains, which will be followed by desirable results, viz., bringing loads nearer to the engine, reducing empty-car movements, reducing the number of cars and locomotives, reducing the cost of repairs and inspection in proportion to the tonnage moved. It will increase the capacity of main lines, freight yards, terminals and sidings.

MR. W. M. PRALL (St. Louis Car Service Association): I will confine myself to the reason for the enormous increase in capacity of freight cars, which, to me, is entirely a question of economics.

There are two factors to be considered: First, good service; second, the competition engendered by the traffic department's persistence in making tariffs based on carload rates instead of tonnage rates. Shippers, in order to attain their individual benefits under the carload rate, have persistently demanded increased capacity in the cars, making the carload the unit upon which they base their contracts with their customers. It has, therefore, become the practice in the United States to consider the carload as the unit, and in large contracts it is to the interest of the vendor to load a car of the greatest capacity in order to attain the largest tonnage sale. Competition has forced the roads to make every effort to comply with the requests of their patrons for large cars. Large cars necessitated large engines and vane improvements in the roadways and terminals in order to give good service. This for the present; now for the future.

It seems to me that it is for the mutual interests of

companies. Cincinnati, for example, was so far south that most of the lines lacked the courage to get anywhere near it, though the "L.M." (Pennsylvania) over-shot the mark. Four of the lines that aimed at Cleveland had to move the city out into the lake, one of them many miles, in order to be able to hit it. A satisfactory composite map should, of course, show the true locations of the whole of each railroad line, but that would be hardly practicable in a sketch of this kind, made on so small a scale.

The correspondent who sends the map says: "The map has been prepared by tracing in upon a correct geographical map the various trunk lines with the principal cities which they touch, as these lines are represented on the individual maps which are published by the respective roads for advertising purposes. Each one of these individual railroad maps has been reduced separately to the same scale as the geographical map, as closely as was possible, and the city of New York, the Atlantic coast line and the great lakes have been taken as general data."

"In this age of uniform practices and standards, why should not the railroads of the country agree on a uniform railroad map? Since traffic associations regulate competition, and rates are made according to the mileage, there is no longer any excuse for distorting the geography of the country by shifting cities around in a manner intended to deceive patrons. If absolute correctness in arithmetic is necessary, why should deception in geography be permitted? And yet it seems to be the approved practice to have your map make the public think that yours is the shortest and directest route between two points, while your figures prove distinctly that such advantage belongs to your competitor."

"The railroad map has come to take quite an important place in educational institutions, but its inaccuracies

Mr. J. S. THURMAN (Mechanical Engineer, Missouri Pacific Railway): I think the trouble that has been experienced with the compound engine and the reason it has not been adopted by more roads than at present is because the builders have been designing these engines and selling them to the railroad companies; the railroad men take a certain amount of pride in what they have designed themselves, and they maintain that they can overcome the defects that are found in them. These matters take time, and we are not yet really prepared for the change from simple to compound locomotives. But my opinion is that the features embodied in the compound engine are essentially correct, and with the slight modifications that may be found necessary, I believe it will become the standard American locomotive.

Prof. J. B. JOHNSON (Washington University): With reference to the future of the compound locomotive, my opinion is the compound locomotive has come to stay. It is peculiarly adapted to American conditions. With heavy loads at moderate speeds, it certainly does save from 15 to 20 per cent. of the fuel cost, as now built and operated, and this is a considerable item. On light train or on high speed service there is little saving of fuel, but where heavy passenger trains are to be hauled at the highest speeds, or when the speed is limited by the steaming capacity of the boiler, there is a considerable reduction in the water to be evaporated, and hence less difficulty in maintaining the pressure. While the cylinder repairs are increased, or perhaps doubled, the boiler repairs are greatly reduced, thus reducing the total expense, because the boiler repairs are the main item. Where the water is had a reduction of the evaporation by 20 per cent. means a reduction of the incrustation by more than 20 per cent., because the incrustation rapidly increases as the impurities accumulate by concentration at the end of the run. The compound loco-

tive has been largely abandoned in England because the loads are small and their speeds high; but wherever the work of the engine is very heavy and the speeds moderate, the compound locomotive is winning its way on its merits the world over. One American manufacturer has turned out over 800 of these improved locomotives, all since 1890, and now at the rate of 200 a year, and all large American railway systems which have heavy work and have given them a fair trial are rapidly approaching their exclusive use in this class of service. The inertia, not to say prejudice, of the average locomotive engineer is largely responsible for the slow adoption of this new improvement, but our master mechanics and

ive looking design, especially for the flat or gondola cars for which it was principally intended. The larger number of cars are, however, box cars, and while in some of the submitted designs a wooden superstructure was shown, applied to the metal underframe, in none was any of the load taken by a trussed frame as in the wood car, and in fact the object of the Committee was designated as the preparation of designs for metal underframing. Without in any way criticising these designs it would appear probable that by utilizing the framing necessary to form the sides of the car for carrying all or a portion of the load, a saving in the total weight might be effected. There are evidently two ways in which this can be done: in one the sides are constructed to carry a portion of the load, practically one-half, the remainder being carried by the center sills. In the other the load

described, but symmetrical with respect to the center. The weight of the frame sheathing, roof, etc., is included. The allowable stresses in the various members are taken as follows:

On framing, 12,500 lbs. per square inch for tension
8,000 lbs. per square inch for compression.
On rivets, 7,500 lbs. for shearing, 15,000 lbs. per square inch for bearing.

By reference to Fig. 1 it will be seen that the posts and braces are made of 3-in. channel, 5 lbs. per foot, and the maximum stress will be 10,000 lbs. for tension and 6,800 for compression, but this weight of metal is required for a reason to be referred to later. The transom post is a 5-in. channel, 6.5 lbs. per foot, and the stress on it is 7,600 lbs. per square inch. The side plate is a 4-in. channel, 5.5 lbs. per foot; the maximum strain for this occurs between the door posts, and for a uniform load is 8,300 lbs. per square inch, but as this is a continuous section an excess is perfectly allowable, and it is prevented from buckling sideways by the roof, fascia boards and door track.

The buffing and pulling strains in this car are taken by two 10-in. channels, 16.5 lbs. per foot, which run the entire length of the car. The combined area of these is 9.8 sq. in., or as great as that in the shank of the coupler, and in my opinion should be strong enough to resist any shock that will not entirely wreck the car. The collapsing strength as a column is about equal that of the four center sills in a 60,000-lb. car, and would appear ample by that comparison.

The center sills have been considered as not taking any portion of a uniformly distributed loading, although, of course, a proportion of the load on the end sills and floor beams adjoining the transom would be transferred to them, but in the case of a concentrated load on one floor beam a part will be carried through the center sills to the adjacent floor beams. The amount thus transferred will depend on the relative deflections of the various members, and may be expressed as an equation as follows, if w pounds be the load taken by the center sills under the floor beam carrying the concentrated load.

Deflection of floor beam under concentrated load less its deflection under a load of w pounds placed at center sills equals deflection of floor beam under one-half distributed load, plus its deflection under load of $w/2$ pounds

placed at center sills plus deflection of center sills under central load of w pounds. On a space of twice the distance between floor beams with a distributed load of 9,300 lbs., an 8-in. channel, 13 lbs. per foot, would be stressed to 13,700 lbs. per square inch. For a load on that beam of 18,600 lbs., and on the adjacent beams of 4,700 lbs., the condition above specified for local loading, the load taken by the center sills is 4,800 lbs. The fiber stress in the 8-in. channel is then 14,800 lbs. per square inch, and in the center sills 6,000 lbs. per square inch, which would certainly not affect their strength to resist buffing.

If the adjacent floor beams were unloaded the stress on the center sills would be increased to 8,000 lbs. per square inch, but this would be reduced should they be deflected by a blow. It is evident by this discussion that the center sills can safely be counted upon to absorb local loads, and will render a section of floor beam that is adapted for a uniformly distributed load, sufficiently strong to

COAL STATEMENT OF COMPOUND AND SIMPLE ENGINES, TWELVE MONTHS ENDING JUNE 27, 1897, CHICAGO, MILWAUKEE & ST. PAUL RAILWAY.

East La Crosse Division.					West La Crosse Division.				
Months.	Style of Engines.	Lbs. of coal per 100 tons hauled one mile.	Cost per ton per mile.	Per cent. saved by compound engine.	Amount saved had all engines been comp.	Lbs. of coal per 100 tons hauled one mile.	Cost per ton per mile.	Per cent. saved by compound engine.	Amount saved had all engines been comp.
July, 1896.	Compound	11.02	.000935	18.5	\$548.21	10.18	.000865	16.1	\$438.11
	Simple	13.32	.001130			12.14	.001059		
Aug. "	Compound	11.37	.000983	22.0	672.98	10.37	.000882	18.2	508.64
	Simple	14.12	.001201			12.26	.001042		
Sept. "	Compound	11.90	.000982	19.7	636.45	10.99	.000907	20.6	509.97
	Simple	14.25	.001117			13.24	.001092		
Oct. "	Compound	10.20	.000867	15.3	494.89	10.57	.000897	23.9	836.22
	Simple	11.76	.001000			13.10	.001114		
Nov. "	Compound	13.82	.001141	20.6	909.34	12.28	.001013	20.8	821.26
	Simple	16.68	.001376			14.83	.001224		
Dec. "	Compound	14.94	.001193	23.5	982.38	12.92	.001077	21.1	716.30
	Simple	17.33	.001473			15.34	.001304		
Jan., 1897.	Compound	15.40	.001508	18.5	447.52	13.32	.001133	16.7	517.42
	Simple	18.25	.001551			15.54	.001521		
Feb. "	Compound	14.45	.001229	19.0	680.17	12.99	.001104	18.0	597.30
	Simple	17.19	.001461			15.32	.001202		
Mar. "	Compound	14.01	.001155	16.0	488.50	12.17	.001004	28.0	725.87
	Simple	16.24	.001340			15.54	.001282		
April "	Compound	12.41	.001055	16.0	478.12	11.63	.000989	15.0	402.53
	Simple	14.36	.001221			13.34	.001134		
May "	Compound	11.38	.000984	18.0	500.78	10.99	.000907	20.0	511.61
	Simple	13.62	.001158			13.06	.001110		
June "	Compound	10.93	.000902	20.0	493.84	9.94	.000820	26.0	668.17
	Simple	13.09	.001080			12.55	.001035		
Average	Compound	12.65	.001064	18.3		11.50	.000968	20.8	
	Simple	14.97	.001260			13.89	.001168		
Total					\$7,353.18				\$7,316.40

superintendents of motive power are, I suspect, not altogether blameless. We hesitate to venture into new and unfamiliar fields when we know we are to be held responsible for results. While a judicious conservatism is both laudable and even necessary in railroad management, I believe any further hesitation to acknowledge the merits of the compound locomotive in the class of traffic named above is a blind shutting of the eyes to demonstrated facts, which will soon be regarded as a sure mark of inefficiency in this department of railroad management.

The accompanying table shows the saving in fuel on two divisions of the Chicago, Milwaukee & St. Paul Railway, as compared between their simple engines and compound engines of the same class, and they have a great many of each class.

This is a statement covering the entire year on two divisions of the road, the record simply showing the saving in coal, which is something of which a record can be kept, and apparently they have been doing equal work. The average saving for one year on the East La Crosse Division was 18.3, and on the West La Crosse Division 20.8 per cent. These figures, I think, speak louder than any man's opinion.

Steel Car Construction.*

H. H. VAUGHAN,†

The possibilities of the steel car are attracting attention to-day, not only from those who are interested in the mechanical problems involved in its evolution, but from other classes of railroad men, those who will, when that much-talked-of improvement gets into actual service, have to keep it repaired and in running order, and those who, endeavoring to make the ratio of paying load to total load hauled as great as possible, are watching all opportunities of decreasing weight.

I should like to state specifically that I do not feel that I can advocate any particular design as final, for no design will probably be final in steel cars any more than it has in wood, but rather as including the principal features, that will become general: as the truss frame has in wood. While I shall describe a certain design I should hesitate to say it is best, but shall simply present it as best in the present state of my opinions.

The design of wood cars now shows but slight variations; that of steel cars is as yet practically undetermined, even in its broad lines, and though if anyone could be certain of the lines that will be followed he would be listened to with attention, yet I must ask you to accept the opinions in this paper as opinions simply and allow me the privilege of changing them should they be shown to be incorrect.

At the 1896 meeting of the Master Car Builders' Association a report was read on Metal Underframing for Freight Cars. As a result of the discussion a Committee was appointed to prepare individual designs to be submitted at the 1897 meeting. Four designs were prepared, three of which while showing a good deal of care in preparation were of a more or less usual type in which metal sills were substituted for the wooden ones previously used, the principal variations being in the method of attaching the draft rigging and of framing the ends. The fourth design was a complete departure from existing practice and was likened by its originator to the plate girder form of bridge construction. The car was entirely supported by the center sills, which formed a strong connection from end to end, and the sides of the car were carried by brackets or cantilevers attached to this central girder. This is a very attract-

ive looking design, especially for the flat or gondola cars for which it was principally intended. The larger number of cars are, however, box cars, and while in some of the submitted designs a wooden superstructure was shown, applied to the metal underframe, in none was any of the load taken by a trussed frame as in the wood car, and in fact the object of the Committee was designated as the preparation of designs for metal underframing. Without in any way criticising these designs it would appear probable that by utilizing the framing necessary to form the sides of the car for carrying all or a portion of the load, a saving in the total weight might be effected. There are evidently two ways in which this can be done: in one the sides are constructed to carry a portion of the load, practically one-half, the remainder being carried by the center sills. In the other the load

The car that I present is a 40 ft., 60,000-lb. box car, a

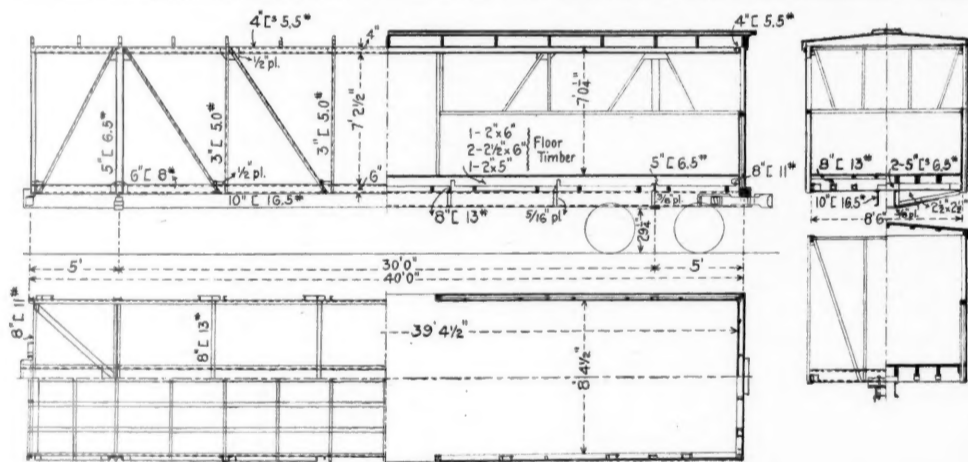


Fig. 1.—Design for 60,000-lbs. Capacity Box Car.

size that is largely in use on the Great Northern Railway, but perhaps not very well suited for comparison. I propose to discuss some of the principles involved in the design of such a car and endeavor to give reasons for my advocacy of it. The width of the car is 8 ft. 6 in. over side sills, and the total floor space is 39 ft. 4 in. \times 8 ft. 4 in., or 330 sq. ft. For a load of 60,000 lbs. this would require a distributed load of 183 lbs. per square foot.

The general design is shown by Fig. 1, and it will be seen that the truss is of the ordinary "N" type with posts in compression. The transoms are 30 ft. centers, and the floor is carried by four beams at the panel points, which are spaced about 6 ft. apart. Each of these floor beams would carry a load of 9,300 lbs. if the load were uniformly distributed, but I consider that the possibility of heavy local loading must be taken into account, and for this I have allowed a double load of 18,600 lbs. on one

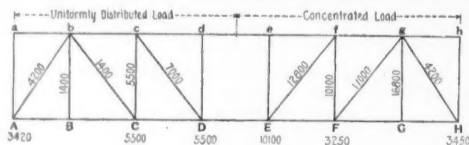


Fig. 2.—Stress Diagram.

floor beam, but under these circumstances have taken the load on the adjacent floor beams at 4,700 lbs., making as before a total of 28,000 lbs. for three beams. I believe that such an assumption will be found to meet all cases that will be encountered in practice, as no machinery or metal will be loaded that would give rise to greater local weights.

The diagram Fig. 2 shows the stresses on the framing, the left-hand side being for a uniformly distributed load and the right-hand side for a load concentrated as above

carry a heavy local load without affecting their strength for resisting buffing forces.

The center sills have an additional duty to perform in the case of unequal loading of the two ends when a shearing force must be transmitted across the door opening where bracing is, of course, impossible. The maximum shear would occur when one end of the car was loaded and the other empty; under these circumstances the shear would be 2,800 lbs. on each side of the car, and would cause bending in the side and center sills, which latter would tend to lift the floor beam on the loaded end of the car and bear on that on the unloaded. As the latter would necessarily be unloaded for such a shear to occur they will easily stand this strain, and if it were entirely taken by the center sills they would only be stressed to about 8,500 lbs. per square inch, since they act as continuous beams for this kind of strain. Some of the shear would evidently be taken by the side sills, but in either case there is ample strength.

I now wish to take up a point that I believe considerable attention must be paid to in steel cars—the strength for resisting bulging of the sides and ends. In the wooden car the ends are formed with two posts and two braces, generally $2\frac{1}{2}$ in. by 4 in. or $4\frac{1}{2}$ in. The sides of a car of 36 ft. or 40 ft. in length have usually two posts between the transom and door posts with three braces. With this construction bulging at the ends is common and in fact is shown by quite a large proportion of cars bulging at the sides is not common, yet there are types of furniture cars that have exhibited weakness in that respect. In steel cars ample strength will have to be provided to resist such strains, especially in members acting as struts, as the fiber stress increases rapidly under combined compression and bending, and the iron has not the same proportion between elastic limit and rupture as timber. The 3 in. channels shown as posts and braces would have if placed with the web parallel to the side of the car about the same strength to resist bending as a $2\frac{1}{2}$ -in. by 4-in. post, the iron at 12,500 lbs. and the wood at 750 lbs., and would be dangerously weak if at all strained. In Fig. 1 it will

* Paper presented at the December meeting of the Northwest Railway Club.

† Mechanical Engineer, Great Northern Railway.

be seen that the posts and braces are placed with the web at right angles to the side or end of the car, so that the strain is taken in the most advantageous way. The strength at a fiber stress of 12,500 lbs. is then about four times as great as that of the wood post, and a secondary advantage lies in the fact that the belt rail braces the post securely in the direction of least strength. I believe that this simple change would prove of great advantage in resisting any tendency to bulge, and will give considerable strength at the ends where the posts are provided entirely for that purpose.

Another point that I wish to call attention to is the method of loading the posts at the top. On consideration it will be seen that if attached on the inside or toward the center of the car, the posts are loaded eccen-

cluded in the latter amount could not be lightened, but that any decrease in weight could be made just as well on a wooden car as on a steel. The relative weights would thus appear to be 7,790 lbs. for a steel car frame and 10,290 lbs. for a wood. Now, while assuming that the car I have described is sufficiently strong, yet the invariable result of a service is to discover weak spots, which are strengthened by a heavier construction, and most departures from existing practice go through the routine. The tendency I should expect in a steel car would thus be in the direction of increased weight rather than reduced, and by the substitution of malleable for cast iron the wooden frame could be lightened to the extent of about 180 lbs. Allowing 500 lbs. for these variations, the advantage in

with wings surrounding the stack, and the position of the sandboxes, together with the queer shape of the cab, combine to give this locomotive a very odd appearance.

Massachusetts Railroad Commissioners' Report.

The Railroad Commissioners of Massachusetts, John E. Sanford, George W. Bishop and Hersey B. Goodwin, have issued advance sheets of the Twenty-ninth Annual Report of the Board. These sheets show the introductory part of the report and the tables made up in the Commissioners' office, but not the full returns from the roads. The part of the report referring to street railroads is also deferred.

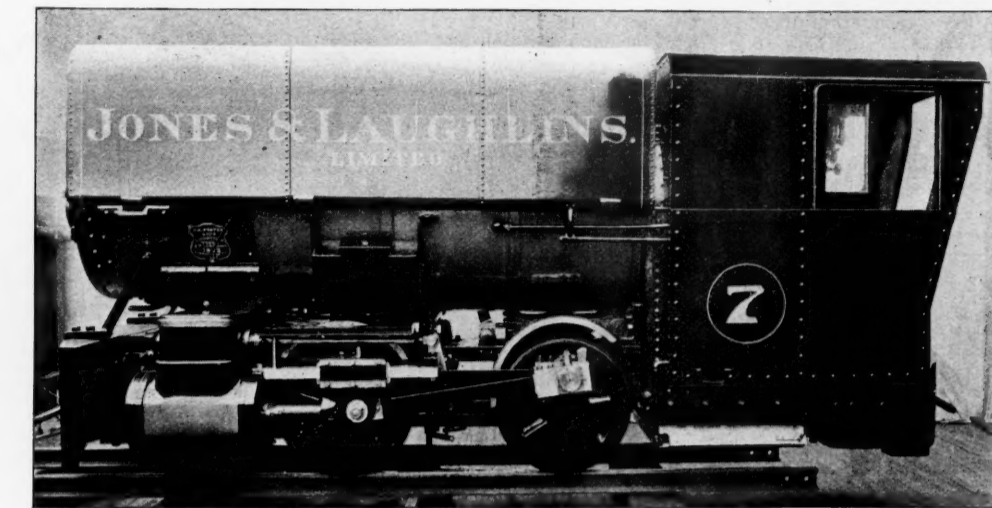
The length of railroad in the state is 2,162 miles, a decrease of 11 miles from 1896, the Martha's Vineyard Railroad having been abandoned and the Worcester & Shrewsbury transferred to the street railroad list. The statistics are for the whole of the lines operated by the companies reporting, so that no figures can be given for the state of Massachusetts by itself. The report, however, gives tables of density of passenger and freight traffic, of earnings and expenses, percentage of expenses to earnings, earnings per revenue train mile, average rates per passenger mile, per ton mile, etc.; and the cost of repairs per train mile for six years classified into eight departments. For one year these averages are given for the five principal roads separately. These five roads do about 98 per cent. of all the business reported to the Board.

The passenger traffic to and from Boston by all roads in 1897 was 72.2 per cent. less than in 1893, the roads on the north side showing a decrease of 13.2 per cent. and those on the south side a decrease of 11 per cent. On the other hand, the street railroads in Boston and vicinity carried, in 1897, 31.2 per cent. more passengers than in 1893.

The report discusses electric operation of standard railroads, as exemplified at Nantasket Beach, and it is said that possibly the laws of the state will need to be changed in some respects to conform to this method of operation.

One passenger, 70 employees and 177 other persons were killed during the year and 62 passengers, 467 employees, 142 other persons were injured. Of the "other persons" 244 were trespassers. No passenger was killed from causes beyond his own control. The accidents from coupling and uncoupling cars, 5 fatal and 188 non-fatal, show a considerable reduction from the average of the last 10 years and a marked reduction from 1893. All train accidents were promptly investigated by one of the inspectors of the Board, but none of the reports are such as to require special mention.

Comparison is made with the records of injuries, fatal



The H. K. Porter & Co. New 21-Ton Locomotive.

trically in such a way as to produce a tendency to bend outward. In the case of a 3-inch channel loaded with 10,200 lbs., there would be a bending movement of 15,300 inch lbs., or a fiber stress of 11,600 lbs. per square inch, which would weaken the post considerably, and in fact be inadmissible. By applying the loads as shown in the figure, that at the top on the outside and that at the bottom on the inside of the post, these forces are balanced at the middle of its length, or would be if the post were free to bend at the bottom, but since it is held rigidly by the connection to the floor beam, there is a tendency for the post to bend inward. The stress caused is a maximum near the top, and does not, therefore, affect the strength as a strut, and should any force or action of the loading tend to bend the post outward it would, until it has overcome the action of the eccentric loading, strengthen the post. The transom post is shown to be loaded on the inside, but this is a 5-in. channel and the movement is only 7,500 in.-lbs., and the connection to the ties is riveted so as to strengthen it in this respect. The connections between posts and ties are shown of simple pressed forms, and are of sufficient length to allow the riveting necessary to transfer the bending caused by their direction not intersecting to the plate or sill. It may be objected that the ties are caused to bend outward, but they are straightened by its action of their load, and the stress would not increase under a slight deflection.

The transom might be modified but would be necessarily somewhat similar to that shown. It is a plate girder with two 5-in. channels for the upper cord and plates and angles for the lower.

The end sill in these cars requires no determinable strength, but it must be capable of standing any ordinary rough usage. I have shown a brace from the transom to the corners, as they should have strength for poling, and as Mr. Barr pointed out in the explanation of his design for a metal underframe, the tendency of the sides to move relatively to the center when the car is suddenly pushed or pulled. This is resisted no doubt by the floor, but I believe a corner brace would be an advantage as long as it is not too stiff.

The attachment of the draft rigging is a point on which there is much room for discussion. Draft timbers may be used which are in their turn attached to the sills, or the draft lugs may be riveted to them directly. There is this to remember, that even if the draft timbers were knocked in, the blow would then be taken by the sills, so that in the case of a severe blow the results would be much the same. With draft rigging riveted to the sills so that it would be practically equal to them in strength, a good deal of repairing would be saved that would be encountered with a timber construction, and I should advocate the direct attachment. The weight of a steel car body of the above construction would be about 17,500 lbs. This weight includes all attachments and fittings, and is that of a car complete and ready to place on the trucks. In estimating it, pine lumber has been taken at 2,500 lbs. and oak at 3,500 lbs. per thousand B. M., which are good average figures. The brakes have been figured as attached to the body, in order to make a proper comparison with a wooden car of the same size and capacity in which that practice is followed.

The details of which the weight is made up are instructive, and are as follows:

Steel frame with centerplates and attached cast-ings.....	6,440 lbs.
Floor beams, belt rails and railing strips.....	1,350 "
Roof and running board lumber.....	2,150 "
Sheeting, side and end door lumber.....	2,470 "
Floor.....	1,270 "
Coupler and draft rigging, deadwood, etc.....	1,220 "
Brakes.....	1,980 "
Side and end door iron work.....	220 "
Hand holds, corner plates, etc.....	250 "
Bolts, nuts, etc.....	160 "
Total.....	17,510 lbs.

The total weight of a 40-ft., 60,000-lb. wooden car body, similar in all respects except frame, is about 20,000 lbs., a difference of 2,500 lbs. Now, by referring to the detailed weights, it will be seen that the first two items, or 7,790 lbs., are all that would be in any way affected by the substitution of steel for wood, and in fact are the equivalent of the frame of a wooden car. The remainder, or 9,710 lbs., would be the same in either case, and by this I do not mean that those portions of the car in-

favor of a steel framed car could hardly exceed one ton. I do not think that a steel framed car could be built more lightly than the one I have described, and in fact I had been led, by some comparisons which I have seen between the weights of steel and wooden cars, to believe that there would be a considerably greater saving than is actually the case. I think there is rather a tendency to compare a steel car, in which all parts are lightened as much as possible, with a wooden car of ordinary construction; but to make a fair comparison the frame alone should be considered, and all weight independent of the type to be the same for both classes.

A decrease in dead weight is undoubtedly an advantage, but there appear to be two methods of estimating its extent. The first is by considering the economy in dead weight as so much extra revenue freight, the second by regarding it as so many ton miles saved in operating expenses. To find the effect of one variable, it is safest to maintain all other conditions as uniform as possible, and in applying this principle to find the saving effected by the use of lighter cars, the total amount of revenue freight, the average carload, and, in consequence, the car mileage, should be considered as constant. Of course, decrease in dead load would mean more cars per train, and thus a fewer number of trains, with a corresponding saving due to the traffic being handled more easily, but the great saving would occur in the lessened number of gross tons hauled one mile. The expense of hauling revenue freight is as an average figure one-half cent per ton-mile; the total mileage of one car, 12,500 miles per annum; the ton-miles of revenue freight, 135,000 per car per annum, and the weight of a car 14 tons. These are average figures, but are not far off the truth. The total cost of hauling both car and freight for one year is thus \$675. The ton-miles of dead freight being 175,000, the ton-miles of gross load, or combined car and freight, are 310,000, and the cost about 0.218 cent per gross ton-mile. A decrease of one ton in the dead weight of a car would thus be equivalent to a saving in operating expenses of about \$27 per year. The cost of the repairs to a car is a quantity that approaches this figure closely, and may vary from \$20 to \$30 per car per annum. Part of these repairs would be common to both types of car—those to the trucks, roof, siding and floors. It could be safely prophesied that draft rigging repairs—that large item in the total—would be far less for the steel cars, although probably not less than for wood cars with steel center sills, and there is the remaining item, repairs due to wrecks, about which experience alone can decide. It is difficult to state what proportion of wrecked cars would be seriously injured, but placing it at two per cent. per annum, even should the car be completely destroyed, the cost would not be large compared to the other amounts considered. On the whole, I believe a saving would be effected in the cost of repairs, and if this could be accompanied with a lessened weight the steel car will easily pay for its greater cost of construction. The trussed frame car in some form or other offers the lightest car for a given capacity, and while it is less sturdy than those with a metal underframe alone, it appears to me the most advantageous form to use.

The H. K. Porter & Co. 21-Ton Locomotive.

One of the oddest locomotives which has yet been turned out of the shops of H. K. Porter & Co. was shipped a few days ago to Jones & Laughlins, Pittsburgh, where it will be placed in immediate service. It has been built for a track gage of 23 in., and the four drivers are 28 in. in diameter. The cylinders are 11 x 14 in., the firebox is 30 in. long by 35 in. wide at the grates and the boiler contains 119 flues, 1 1/2 x 82 in., designed to carry a steam pressure of 160 lbs. The tank capacity is 400 gals. The height of the locomotive is 7 ft. 3 in., the width over the rear bumpers 49 1/2 in., the width over the cylinders 58 in., and the width over cab 54 in. at the front part and 47 in. at the rear end. Swivel link couplings in caststeel drawheads are used. The total length over drawheads is 16 ft. and the weight complete is 21 tons. The tapered stack (not seen in the engraving), the extension front, the saddle tank,



Cab of the H. K. Porter & Co. Locomotive.

and otherwise, to passengers in Great Britain, attention being called to the fact that in England considerable numbers are killed and injured by falling between cars and platforms, by falling out of cars while trains are in motion and by the closing of car doors, causes which do not figure in Massachusetts reports.

A chapter of the report is given to the subject of safety appliances, and the operation of the law of the state is recounted. Railroad officers in Massachusetts hold that about 30 per cent. of the cars in a freight train is generally a sufficient number to control the speed of

(Continued on page 64.)



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At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

In this issue Prof. S. A. Reeve closes his articles on "The Gas Engine and Its Mission" with a discussion of its possible future. In the three previous articles he has laid the foundation for this, the most important part of his subject, and in departing as he does from the beaten paths followed by the warm adherents of the so-called Otto cycle, he may arouse strong opposition from many quarters. In fact, criticisms have already been forthcoming. With a strong conviction regarding the present limitations and the possible future extension of the industry he has taken an independent position, but not without a knowledge of the advances made both in this country and abroad by following the almost universal practice. If the author is accused of attempting to tear down instead of encouraging and building up the industry in this country, it may be remarked that his conclusions are not those of a casual observer, but rather of a careful and critical student, and his interest in the subject has grown out of a firm belief that the gas engine industry generally has got into a rut in which it is likely to remain unless radical means are adopted to overcome existing prejudices. It should be pointed out that this is not a treatise on the subject; neither does the author attempt here to solve the problem of the mission of the gas engine, but he has pointed out a possible future and has gone so far as to give a hint to the solution of the question. We should be pleased to receive criticisms and suggestions from those interested, and especially from manufacturers, who we have very frequently found are unwilling to part with their information, much to the hindrance of the progress of the industry.

Steel Car Construction.

Among the valuable papers lately presented at Railroad Club meetings that by Mr. H. H. Vaughan, on "Steel Car Construction," deserves careful attention, especially as the subject treated is one of the most important which could be selected at this time; and we reprint it practically in full. Mr. Vaughan describes and discusses the details of a 60,000-lbs. capacity steel box car, 40 ft. long, designed for the Great Northern Railway. The designer has tried to make as light a construction in steel as possible without sacrificing strength, and to accomplish this some novel features are introduced. The total weight of the lading is carried by two outside trusses which form the sides of the car, while two 10-in. channels, which are practically the center sills, take up the stresses from the buffing and pulling forces. In addition, these center channels carry such light loads as come on them through the deflection of the floor on cross-beams which are connected with the bottom chords of the trusses at the several panel points.

This will readily be recognized as an arrangement quite different from the designs submitted at the 1896 and 1897 meetings, by the M. C. B. Committee on Steel Underframing for Freight Cars. The designs submitted by the Committee were for cars 34 ft. long inside measurement. In all of these the load due to

the car lading was carried by the sills, and the side trusses simply formed the skeleton for the box, as in wooden-car construction. In some of these designs truss rods were used, while in others the sills were made sufficiently deep to give the necessary vertical strength without truss rods. The fundamental difference between the design of Mr. Vaughan and those of the M. C. B. Committee can probably be better brought out by referring to similar constructions in bridge work. Mr. Vaughan's design for carrying the load is based on the same principle as the through truss bridge, while the M. C. B. Committee made use of the principle of the deck girder.

Great stress is now being laid on the amount of dead weight saved by steel car construction, and with this in view it is interesting to note that the underframe of one of the M. C. B. Committee's designs weighs complete 6,959 lbs., the corresponding parts of a wooden car 9,626 lbs., while Mr. Vaughan estimates that his steel frame with center plates and attached castings will weigh 6,440 lbs.

In discussing this paper at the Club meeting, Mr. M. Toltz, Bridge Engineer of the Great Northern, suggested that it might be more economical to have both the sills and side trusses carry the weight of the lading than to have this weight carried by the sills alone or the side trusses alone, and stated that the underframe of such a car as he had in mind would weigh 4,500 lbs., and the two side trusses together would weigh 3,000 lbs., which would make the light weight of the car complete 26,600 lbs., or about three tons less than the present wooden cars weighing 32,500 lbs. It should be borne in mind that the M. C. B. designs were for 34-ft. cars, inside measurement, while both Mr. Vaughan and Mr. Toltz are figuring on cars 40 ft. long.

It might also be well to point out that in all the designs mentioned commercial shapes are used exclusively for the main members and that it is well known that the weight of such frames can be considerably reduced by using pressed steel instead of rolled forms. The pressed steel construction might increase the first cost of the car slightly, but much weight can be saved by the reduction in the depth of the sills toward the ends to correspond to the variation in the bending moment, and the reduction of the dead weight of the car is very important. Information is not now at hand which would show just how much weight could thus be saved on cars of 60,000 lbs. capacity, but judging from what has been accomplished in building cars of greater capacity, we should think that the use of pressed steel shapes would be well worth considering in any design of metal car.

On account of the lively interest which is being taken in steel car construction it is likely that many designs for steel cars will soon be brought forward, and the prospects are that these will differ widely; there is little ground for reasonable hope that there will be uniformity even in the most essential parts. It is barely possible that such conditions may result in the more rapid development of the steel car, so that from a great many designs several practicable types of construction may finally be selected and generally accepted as the best practice. However, in the beginning the steel car movement will be helped along if new designs, which promise to be better than some already exploited, are made public.

December Accidents.

Our record of train accidents in December, given in this number, includes 107 collisions, 95 derailments and 6 other accidents, a total of 208 accidents, in which 28 persons were killed and 195 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted, except where the circumstances of the accident, as reported, make it of special interest.

These accidents are classified as follows:

COLLISIONS.		Rear.	But-	Cross-	Total.
		ing.	ting and	ing and	
		ing.	other.	other.	
Trains breaking in two.....	19	0	0	0	19
Misplaced switch.....	3	2	3	8	
Failure to give or observe signal..	6	2	3	11	
Mistake in giving or understanding orders.....	0	3	0	3	
Miscellaneous.....	7	6	7	20	
Unexplained.....	16	10	20	46	
Total.....	51	23	33	107	
DERAILMENTS.					
Broken rail.....	4			2	
Loose or spread rail.....	1			2	
Defective switch.....	2			2	
Defective frog.....	1			1	
Broken wheel.....	3			2	
Broken axle.....	3			1	
Broken truck.....	4			3	
Failed brakebeam.....	1			1	
Failure of drawbar.....	2			2	
Broken car.....	2			2	
Misplaced switch.....	4			53	
Bad switching.....	1			95	
OTHER ACCIDENTS.					
Boiler explosion.....	1			1	
Broken side rod.....	3			3	
Other causes.....	2			6	
Total number of accidents.....	208				

A general classification shows:

	Colli-	Derail-	Other	Total.	P. c.
	sions.	ments.	accid's.		
Defects of road.....	0	8	0	8	4
Defects of equipment.....	19	15	4	38	18
Negligence in operating.....	42	10	0	52	25
Unforeseen obstructions.....	0	9	2	11	5
Unexplained.....	46	53	0	99	48
Total.....	107	95	6	208	100

The number of trains involved is as follows:

	Colli-	Derail-	Other	Total.
	sions.	ments.	accid's.	
Passenger.....	40	23	3	66
Freight and other.....	137	75	3	215
Total.....	177	98	6	281

The casualties may be divided as follows:

	Colli-	Derail-	Other	Total.
	sions.	ments.	accid's.	
Killed:				
Employees.....	16	2	0	18
Passengers.....	2	0	0	2
Others.....	7	1	0	8
Total.....	25	3	0	28
Injured:				
Employees.....	103	26	6	135
Passengers.....	28	22	0	50
Others.....	5	4	1	10
Total.....	136	52	7	195

The casualties to passengers and employees, when divided according to classes of causes, appear as follows:

	Pass.	Pass.	Emp.	Emp.
	Killed.	Injured.	Killed.	Injured.
Defects of road.....	0	0	0	2
Defects of equipment.....	0	0	0	5
Negligence in operating.....	2	49	16	108
Unforeseen obstructions and maliciousness.....	0	0	0	5
Unexplained.....	0	1	1	15
Total.....	2	50	18	135

Fifteen accidents caused the death of one or more persons each, and 50 caused injury but not death, leaving 143 (69 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with December of the previous five years shows:

	1897.	1896.	1895.	1894.	1893.	1892.
Collisions.....	107	29	72	66	84	107
Derailments.....	95	60	79	69	77	95
Other accidents.....	6	6	6	7	5	10
Total accidents.....	208	95	157	142	166	212
Employees killed.....	18	43	41	24	24	37
Others killed.....	10	19	7	5	7	4
Employees injured.....	135	53	84	58	85	110
Others injured.....	60	37	115	32	120	119
Passenger trains involved	66	26	56	58	64	84

Average per day:

Accidents.....	6.71	3.06	5.06	4.58	5.36	6.84
Killed.....	0.90	2.00	1.55	0.94	1.00	1.32
Injured.....	6.29	2.90	6.42	2.90	6.74	7.39

Average per accident:

Killed.....	0.13	0.65	0.31	0.20	0.18	0.19
Injured.....	0.94	0.95	1.27	0.63	1.25	1.08

Only two passengers were reported killed in December and one of the two was riding on a freight train. The most disastrous accident of the month was that at Altoona, on the 20th. The circumstances of this collision are clearly described in our account. There was an investigation by a coroner, but we have not heard that any verdict has been rendered. About one week after this disaster the newspapers reported another runaway down the same grade, the train passing through Altoona, it is said, at the rate of about a mile a minute. The track had been cleared to Bellwood, seven miles beyond Altoona, and the train was stopped without damage. The next most troublesome accident in December seems to have been that in a tunnel near Wilkes Barre, on the 12th, though here, as in the case first mentioned, the record of personal injuries is remarkably light. In the collision reported at Fort Smith, where one passenger was killed, it is said that a torpedo had been placed to protect the passenger train, but that it did not explode. A somewhat remarkable accident occurred at Castle Rock, Colo., on the 19th, and another case from an unusual cause was the butting collision at Clark's Summit, Tenn., on the 24th. The worst passenger train accident was that at Vail, Ia., on the 18th, but strange to say, no person was killed. As remarked by a local newspaper, this accident ought to prove of benefit to the inventors of devices for receiving mail bags from moving trains. The derailment of a passenger locomotive which was running backwards near Gilroy, Cal., on the 12th, is said to have been repeated on the 19th, which would seem to indicate either a poor track, or a badly designed tender, or perhaps too high speed.

Seven persons were killed and three injured in three boiler explosions in December, which do not appear in our record. One of these accidents was on a logging railroad, one was a locomotive in a roundhouse, and one was on a street railroad at East Titusville, Pa. There was a runaway on a logging railroad at Rumford Falls, Me., in which one person was killed and five injured.

There were 11 electric or street railroad accidents in December. In one of these, a butting collision near Pontiac, Mich., three persons were killed and 20 injured, one of the killed being the superintendent of the road. This appears to have been a case of fog, slippery track and careless running. In the other 10 accidents 17 persons were injured. There were three runaways on steep grades and four collisions.

Near Patterson, N. J., on the 22d, an omnibus was struck on a highway crossing by a locomotive of the Erie road and 14 persons were injured. In a similar accident near Utica, N. Y., one person was killed and seven injured. In each of four other cases two persons were killed on a highway crossing.

Annual Reports.

Lehigh Valley.—The last fiscal year of the company, ending Nov. 30, included important changes affecting the future of the company, and the report, which is just at hand, therefore has special interest. The changes in volume of traffic and revenue were not important, anthracite coal and miscellaneous freights showing a loss in tonnage carried and in revenue, but passenger travel showing an important gain, so that the increased income from this source and mail and express business, \$142,506, more than offset the loss of \$131,789 in revenue from coal and general freights. Miscellaneous receipts from coal docks, rents, etc., however, fell off \$93,537, so that there is a slight loss in gross earnings, which, however, is more than made good by savings in working charges. Net earnings are thus \$214,000 above the 1896 figures. The following is a comparison for three years:

	1897.	1896.	1895.
Gross earnings.....	19,559,166	19,514,660	18,554,454
Operating expenses.....	14,413,230	14,583,638	14,128,433
Net earnings.....	5,145,836	4,931,022	4,426,021
Other income.....	1,036,288	676,159	990,915
	6,182,124	5,607,181	5,416,936
State taxes.....	260,070		
Bal. of interest account.....	25,117	673,369	589,691
Loss on Morris Canal, etc.....	239,933		
Int. on funded debt and fixed rentals of leased lines.....	4,744,205	4,484,033	4,394,389
Interest on Lehigh coal bonds.....	710,204	590,650	586,625
Total charges.....	6,679,461	5,748,149	5,480,699
Balance.....	sur. 112,663	def. 140,888	sur. 46,217

The largest portion of the company's revenue is from coal, its income from this source in 1897 being \$8,560,418 against \$7,403,471 from miscellaneous freights and \$2,672,547 from passenger traffic. How serious has been the falling off in the demand for anthracite is illustrated by President Walters' statement that the output of anthracite from all regions in 1897 was $1\frac{1}{2}$ million tons less than in 1896, when it was $3\frac{1}{4}$ millions less than in 1895. The falling off in the coal tonnage of the Lehigh Valley since 1895 is shown in the following table:

Tonnage.	1897.	1896.	1895.
Anthra. coal.....	10,278,410	11,334,551	12,945,368
Bitum. coal and coke.....	1,251,637	819,938	458,191
Ton Mileage.	1897.	1896.	1895.
Anthra. coal.....	1,174,970	1,265,097	1,293,672
Bitum. coal and coke.....	98,893,358	68,854,844	29,973,444
Ton mile rate on all coal, mills.....	6.72	6.46	6.40
Ton mile rate on coal (excl. of supply coal), mills.....	7.12	6.83	—

Another phase of the company's traffic makes a much more satisfactory record of progress. The passenger statistics show a largely increased movement and revenue, but the growth of the general freight is perhaps of special significance. As bearing on this point, we give below the more important figures of general freight and passenger business in the 1897 report in comparison with the figures reported in 1895, the changes in these accounts furnishing a striking contrast to those reported for the company's coal traffic.

	1897.	1895.
General freight earnings.....	\$7,403,471	\$6,819,662
Passenger earnings.....	\$2,672,547	\$2,316,519
Passengers carried.....	4,881,610	4,718,037
Passenger-miles.....	135,489,011	117,282,636
General freight tonnage.....	6,339,576	5,857,625
ton mileage.....	1,548,289,000	1,283,201,000
Average train haul, gen. frt.....	244	—
total frt.....	153	—
Ton-mile rate on gen. frt., mills.....	4.78	5.34

Here, then, is an increase of \$554,000, or 8 per cent., for revenue from general freight and a gain of 265 million ton-miles, equal to 20.6 per cent. The commodity tables show that 462,000 tons of the increase in shipments is accounted for by the larger grain traffic. This was only 587,000 in 1894, increasing to 943,000 in 1895, reaching 1,471,000 tons in 1896. The total fell in 1897 to 1,405,000 tons.

The details of operating expenses show a decrease of \$129,424, as compared with 1896, in cost of maintenance of way, and of \$582,641 in cost of handling traffic. Maintenance of equipment charges were \$392,177 larger than last year.

Much the largest part of the report is taken up with the financial accounts, and in these the largest interest lies. It is now an old matter that the financial necessities of the company became acute during the early part of 1897, and that J. P. Morgan & Co. made large advances to tide the company over its most pressing obligations and that they now hold an important if not dominating influence in the management. It was well known that the large advances which the railroad had been compelled to make to the Lehigh Valley Coal Co. were the immediate source of the railroad's difficulties. How large these were is shown by the balance sheet in the 1896 report, the advances there being put down as \$5,165,890. During the year the Coal Co. has issued \$5,000,000 of its bonds in liquidation of these claims, but the 1897 report still shows advances due amounting to \$1,079,915.

The Lehigh Valley reports have heretofore not been very full, and indeed, it is not so many years ago that they did not contain a balance sheet. A marked change has been made in the present report, which is very complete. Mr. Stephen Little has audited the figures, and the accounts have been readjusted in important respects. The most important change has been the reduction of the profit and loss account. The credit balance

in this account on Nov. 30, 1896, was given as \$7,534,277. It has now been reduced to \$377,478. The largest reductions were effected by writing off \$5,347,794 to depreciation in equipment; \$683,337 for interest on funded debt and guarantees accruing prior to Dec. 1, 1896; cost of signal plant prior to Dec. 1, 1896, \$157,567, and other items to a total of \$7,391,118.

During the year about 2,500 coal cars and other equipment, to the value of \$635,320, have been destroyed, and the amount named deducted from operating expenses and credited to reserve account.

The Fight Against the Scalpers.

Mr. Daniels has issued in pamphlet form his last argument before the Congressional committees at Washington on the proposed law to prohibit ticket brokerage. The matter fills 36 pages, and documents filed with the committee in connection with the argument would fill 3,600 pages; at least we judge so from the list of them which is given. The whole subject is gone into in a very thorough manner and the pamphlet has an index filling one whole page. Mr. Daniels begins with a text of scripture, from which the reader will naturally expect an earnest argument, and that is what he finds.

A facsimile is given of the impression of a counterfeit stamp used by a New York scalper in 1895 to validate return portions of Boston Christian Endeavor tickets. The principal arguments against allowing the continuance of the illegitimate business of ticket brokerage, both as given by Mr. Daniels and by other railroad officers, have already been given in the *Railroad Gazette*. In the present case Mr. Daniels supplements these by a great mass of facts. For example, he gave the committee a circumstantial account of fraudulent doings in connection with tickets, in the office of George M. McKenzie, at Chicago, on the very day that Mr. McKenzie was making his statement before the committee in Washington. Mr. Daniels showed envelopes given out at the scalper's office, which were to be used by a passenger for fraudulent identification. The passenger, named Brown, was to assume the name of John Lovell, and the scalper gave him four envelopes which had contained letters addressed to the so-called Lovell. The affidavit of Woolley, presented by Mr. Daniels, was given in the *Railroad Gazette* of Jan. 14. Thirty certified copies of indictments against ticket scalpers, as found in the United States courts, were a part of the evidence presented. Some of these were against McKenzie and E. A. Mulford, the latter having been for several years the partner of McKenzie.

Mr. Daniels declared that the Illinois anti-scalper law had never been held unconstitutional, as claimed by the brokers. Seven legal decisions have held that such laws were constitutional. The case of the people of New York vs. George Tryoler, involving the constitutionality of the present law of that state, was before the Supreme Court on Dec. 31 last, and the application for a writ of habeas corpus on the ground that the law was unconstitutional was denied.

The argument of the scalpers that their offices are necessary for the weak lines was met by Mr. Daniels with the statement that they could easily be appointed agents for such lines. The proposed law does not forbid this. Referring to Mr. McKenzie's intimation that the railroads, though asking, as they say, for a righteous law, do not come before Congress with clean hands, Mr. Daniels asserted that all that was asked for was a law that would reach dishonest men, whether within or without the railroad service. Selling any interstate ticket at less than the published rate is a virtual violation of the law. The railroads that appeal to Congress have nothing to conceal.

If Congressmen are not wholly blind to reason, they must, we think, acknowledge the overwhelming force of such arguments as those that have been presented by Mr. Daniels and Mr. Boyd. Yet, narrow political partisanship and sectional prejudices still have great power in deciding votes, and it is impossible to predict what Congress will do. The legislature of Tennessee has passed a resolution requesting the Congressmen from that state to vote against the anti-scalping bill.*

So much for what is going on at Washington. Meantime the railroads at Chicago, having been accused of indifference in not trying to get the Illinois State law enforced, have secured the indictment of nine prominent brokers of that city, Messrs. B. D. Marks, George Frank, Johnson & Brooks, David Wasserman, R. C. Davis, Hogan D. Cosby, Edward Ullman, Albert J. Geis and William Nye. Broker McKenzie, who is now in Washington, was the subject of a complaint, upon which, according to Assistant State's Attorney Sprogle, an indictment will be returned this week. The evidence was given on Saturday by representatives of ten prominent railroads. The law, which provides heavy penalties, was passed April 19, 1875, and was held to be constitutional by the United States Supreme Court, in 1894. (See *Railroad Gazette*, May 11, 1894, page 342). The principal witnesses before the Grand Jury were: C. A. Higgins, A. F. Merrill, G. J. Charlton, and G. W. Duback. All the principal roads were officially represented. W. H. Blase, ticket broker, was indicted on the evidence of John Wallace, of Nelsonville, O., who charged Blase with selling him an editorial ticket, which was refused by the railroad company. In a statement issued by the Attorney for the railroads a list is given of 10 particular violations of the law, the

* The House Committee has reported the bill to the House, as noted under another head in this issue.

details of each case being published as given by the detectives of the road.

The International & Great Northern has made arrangements with grocers and general storekeepers at Houston, Taylor, San Antonio and other points by which track repairsmen, living at places remote from towns, can get their family supplies at reasonable rates without the inconveniences which have heretofore attended this branch of their domestic economy. From a circular issued a few months ago, and which was published in the *Austin Statesman*, it appeared that the company at first made arrangements with a single merchant, and that there was some criticism of the scheme on the ground that it was a discrimination against other merchants; but as now arranged the plan appears to be unobjectionable. The *Dallas News* says:

The International & Great Northern has adopted a system that must result materially to the benefit of the section men on that road. The object is to encourage section men to take care of themselves by paying cash for their supplies. Arrangements have been made whereby section men can buy groceries, dry goods, etc., and deductions made on the pay rolls. Section foremen will order such supplies as their men want, on blanks which will be furnished them. The foremen will be held responsible for all goods ordered in excess of the amount due each section man for labor at the time of delivery. Section men who are actually boarding their men, not furnishing them supplies, or standing good for them at stores, will be allowed to continue boarding them, charging them not over 40 cents a day, including Sundays, but nothing but actual board will be deducted in favor of a foreman or boarding boss, as the company wishes to encourage the men to board themselves wherever practicable. The company does not want to force the men to buy at any particular house, but has made this kind of an arrangement with different houses in the cities named, simply for the accommodation of section men who have not money or credit, to prevent it being necessary for the foreman to stand good for them, or to buy and supply them. The company gives notice that after these arrangements go into effect, employees making bills and not paying them will be dismissed from the service on receipt of complaints from the firms to whom they are indebted.

A common fault of American general passenger agents, if we may believe a prominent member of their association who addressed them at their St. Louis meeting, is "self-flattery," and one of the amusing ways in which they have long humbugged themselves, with no effect on the public, is in map-making. The humors and absurdities of railroad maps are apparent to the ignorant and smiled at in easy toleration by even the geographers of the daily newspapers, but to properly appreciate them one must compare the maps, somewhat in detail, with a correct map. A sketch by a correspondent who has done this is given on another page of this paper. The main suggestion of our correspondent, that any company ought to be satisfied to depend wholly on heavy lines for magnifying the importance of its own railroad without distortion, is perhaps sound, but it will not prevail until the G. P. A. acquires a higher respect for the intelligence of the average man. We remember having seen the phrase "geographically correct" on railroad maps now and then, though we cannot recall the names either of the roads or of the courageous general passenger agents who issued the maps. The general passenger agent of one of the lines from Chicago to Omaha once got mad at the way in which a competitor wiped out curves and got out a map showing his own road as a perfect air line, about five miles thick, for 500 miles, but then he relented and said in a note that this was a "railroad" map.

The Committee on Cement Tests of the American Society of Civil Engineers has sent out a list of questions which goes to each member of the Society and to many others known to be interested in the matter or to be likely to be able to give information. The committee is a particularly strong one and the results of its labors are sure to be valuable. The list covers about 75 questions and the committee wishes to get the names and addresses of any persons not members of the Society who are likely to be able to answer some of these questions. From long observation of work of this sort by committees of different bodies we think that it is probable that the number of answers received will be very much smaller than anyone would suppose it should be, and that the answers will be much less definite than one would expect to receive from so intelligent a body of men as the American Society of Civil Engineers. We take the liberty of suggesting that now is time for the members of the Society, by contributing from their knowledge and experience, to help to settle for many years to come some very vexed questions. The Chairman of the Committee is Prof. George F. Swain, Massachusetts Institute of Technology, Boston, Mass.

A week ago a gentleman who ought to know stated in court in Chicago that the Chicago, Milwaukee & St. Paul will adopt electricity on its suburban lines. The officers of this road neither confirm nor deny this statement. As a matter of fact, the St. Paul has for a good while been making careful investigation into this matter with a view to electrifying the Evanston Division. According to the plan this will be worked in connection with the Northwestern Elevated, and thus the suburban trains of the St. Paul will be brought directly into the heart of the city over the Union Loop. Such an arrangement would be an extraordinary and we should suppose popular and successful arrangement for handling suburban traffic. Indeed, it would be the nearest to the ideal arrangement of anything that has yet been installed. We believe it to be quite true that this is likely

to be carried out, but inasmuch as the Northwestern Elevated cannot be finished for something like a year, and inasmuch as the money for finishing that road does not seem to have yet been provided, the complete working out of this scheme may be delayed some little time.

NEW PUBLICATIONS.

A Practical Treatise on Modern Gas and Oil Engines. By Frederick Grover. London: The Technical Publishing Co., Ltd.: 255 pages, $3\frac{1}{2} \times 7$ in. Price, 4s. 6l.

In the preface the author states that he has endeavored to supply the average draughtsman with sufficient data to enable him to apply his knowledge to the design of gas engines. We feel this has hardly been accomplished, although he has certainly gone a long way in the right direction. The gas engine is a study by itself, as is the steam engine, and it would be rather questionable if even a trained engineer could, after reading a book on the subject, design a gas engine without at least some previous knowledge of the subject. The author bears upon the importance of shop practice, and in this we heartily concur, as most of the former failures in gas-engine design can be traced directly to defective work in the draughting room due to insufficient shop practice, and to the anxiety to place the engine on the market.

The first chapter is devoted to an historical sketch of the gas engine. This chapter is short, covers the ground accurately, and in it the writer has not burdened the reader with unnecessary data before discussing the more important part of his subject.

A very interesting chapter follows on the arrangement of an engine-room. Considerable is said regarding the vibration and odors so frequently met with in large gas engine installations. While there is certainly some vibration, especially with the English type of engine, and also some smell, nevertheless our experience leads us to believe that undue precaution to avoid these defects has been recommended. We have found that even with engines of over 100 H. P. the transmission of vibration from the engine to the walls and pipes of the building may be successfully obviated by having a few feet of soft earth between the building and engine foundations, and making flexible pipe connections. Regarding the vibration of the air, this may be entirely dispensed with by increasing the number of cylinders and adopting higher speeds. A few suggestions are made regarding the proportioning of gas meters to the work they are required to perform, and a rough method of ascertaining their proper size is given. This data should prove useful to the erecting man, as gas companies frequently underrate the amount of gas required, and install a meter too small for the work, thus causing a loss of power in the engine. Rules are also given for finding the proper size of the gas and exhaust pipes. These rules give rather larger pipes than necessary, especially where a multiplication of cylinders is employed instead of one large cylinder; they are on the safe side, however.

A few pages are then devoted to the various types of gas engines. It is needless to say that all of the engines described are English; interesting to Americans as matters of record, but of little use as guides in general design, there being many reasons why the English type of engine could not be thoroughly successful in this country. The prevailing English devices for self-starting are described. These starters all have the well-known defects of uncertainty, and of not being powerful enough to start up under load. The information given, however, is well presented and necessary to render the work complete.

The testing of gas engines forms another subject, which the writer treats briefly, giving some general data on brakes, how to apply them, method of taking readings and calculating the results. Data is also given on indicating, with methods of attaching the indicator, and obtaining the required motion. A general discussion on engine trials follows, with notes on calorimetry and a simple way of analyzing gas. A chapter on gas-engine design comes next. Under this heading formulae are given for calculating, among other parts, the size of cylinder, volume of compression space, size of shaft required, diameter and weight of flywheel necessary and best proportions of the connecting rod. The rules given are arbitrary; the results, however, are fairly accurate for English practice, and in any event are safe.

Producer gas and its application to gas-engine practice are briefly discussed; little data, however, is given under this heading.

Considerable space is devoted to experiments to determine the effects of products of combustion upon explosive mixtures. These tests are certainly of interest, and the results and conclusions given are in the right direction.

The author very properly commences his discussion of oil engines by giving a few points relative to the physical properties of petroleum. Unfortunately there is but little data given, which is always of great interest to engineers, and especially in connection with oil engine practice, of which so little is known. It would be well, therefore, to caution those interested in petroleum engines not to undertake their design without a thorough knowledge of the subject, as almost certain failure will result. The oil engine is as much of an independent study as either the gas or steam engine, and it does not follow that a man successful in the design of gas engines can obtain satisfactory results with oil engines. An oil engine may be regarded as a totally new machine, of which comparatively little is

known, and those possessing the information are not particularly anxious to impart their knowledge. A few of the various English and European types of oil engines are described, and the book closes by giving some results of tests made.

The work, as a whole, is good and well worth having. It is remarkably free from mathematics and presents its various subjects in a straightforward and clear manner.

Third Annual Report of the Boston Transit Commission. Year ending Aug. 15, 1897. Boston: Press of Rockwell & Churchill, 1897.

The third report of the Boston Transit Commission brings the story of the admirable work done by that Board up to the middle of last August. The report is carefully detailed in text, and contains many excellent heliotype illustrations, together with a progress map of the subway work and a number of line drawings of details. It thus becomes a valuable engineering document.

The report of the Commission proper is but 21 pages. This is followed by the report of the Chief Engineer, Mr. Howard A. Carson, 44 pages, and the report of the Chief Engineer for the Charlestown Bridge, Mr. William Jackson, 14 pages. Appendices give the contract with the West End Company, a statement of the progress in equipment, the text of the Rapid Transit Act, statistics of traffic, and details of bids for the various parts of the work.

The Monthly Official Railway List. The Railway List Co., The Rookery, Chicago; pp. 398, $4\frac{1}{2} \times 8\frac{1}{4}$ in. Price, \$1 a year.

After 16 years as an annual publication the Official Railway List appears in January in a monthly edition. The fact that the list is to be published monthly will add much to its value on account of the many and frequent changes that occur in the personnel of railroads. A special feature will be the use of four colored pages, containing changes received too late for use in the body of the book, thus bringing the list up to date at the time of being mailed. The names of the railroads used in connection with the alphabetical list of railroad officers in the back of the book are given with much less abbreviation than heretofore, rendering reference to the body of the list unnecessary in most cases. The same applies to the index to railroad general officers and shops.

A Field Manual for Railroad Engineers. By J. C. Nagle, M. A., Professor of Civil Engineering in the Agricultural and Mechanical College of Texas. New York: John Wiley & Sons, 1897. Flexible morocco, with flap; pp. 394. Price, \$3.

Professor Nagle has aimed to make a convenient and sufficiently complete pocket book for the field engineer and also a text book for use in the schools. The ground covered is that usually included in the scheme of such books, beginning with reconnaissance and running through to construction, with something over 30 of the usual tables.

TRADE CATALOGUES.

Hoisting Engines and Boilers.—The Lambert Hoisting Engine Co., of Newark, N. J., and of 143 Liberty street, New York, and 117 Main street, Cambridgeport, Mass., issue a catalogue of hoisting engines and boilers for contractors and for all the numerous purposes to which hoisting machinery is applied. The catalogue illustrates and describes in considerable detail a variety of such machinery, including even such comparatively recent contrivances as electric hoists. A double friction drum electric hoist is shown as designed for use on boom derricks, quarry work, building and sewer construction, etc. The machine as designed and made by this company occupies a minimum of space. Both drums turn in the same direction. It is worked entirely by means of a lever handle, and it automatically holds the load suspended at any point. It is built in sizes from 5 H. P. up to 60.

Bolt Threading and Nut Tapping Machinery.—The Detrick & Harvey Machine Co., of Baltimore, Md., issues a 64-page 6×9 in. catalogue describing principally the Adams bolt threader. Single and double threaders made for different size threads are well illustrated and accompanied by a complete price list. The parts of the Adams automatic device for opening and closing the heads of the die are shown somewhat in detail.

Machine Tools.—The Hilles & Jones Co., of Wilmington, Del., has issued catalogue "O" illustrating the numerous types of heavy machinery for punching and shearing. The catalogue also contains illustrations of the patented beam coping machine, beam and channel shearing machine, plate bending rolls and double angle shear. Some of these have been described in previous issues of the *Railroad Gazette*.

The Davis & Eggn Machine Tool Co., Cincinnati, O., sends us a catalogue for 1897-8, being a thick, 12mo volume of 382 pages. It shows a large variety of machine tools, fixtures and attachments, these being illustrated by line drawings and described at considerable length. The volume contains also considerable special information of a commercial and technical kind.

Massachusetts Railroad Commissioners' Report.

(Continued from page 61.)

the train by air brakes, and that to promote convenient operation each company should have about 60 per cent. of its own cars equipped with such brakes.

The number of grade crossings in the state, 2,103, is 52 less than in 1896; eight of this decrease is due to the elimination of two companies as before mentioned and 43 have been abolished by the construction of bridges. Something over one-half of the crossings are protected by gates, flagmen or electrical signals. On the Boston & Albany there are 233 crossings, of which 71 are protected; on the Boston & Maine 620 crossings, 436 protected; on the New York, New Haven & Hartford 748 crossings, 447 protected. Twenty-seven crossings are in process of abolition, and petitions have been made for the abolition of 126 more.

During the six years since the passage of the grade-crossing law the state of Massachusetts has expended on these improvements \$2,452,043. A part of this is on account of the towns, and the state will be reimbursed, with interest, so that the actual cost incurred by the state to Jan. 1, 1898, is \$1,814,956. This is under the general law. Under the special act applying to crossings of the Boston & Providence in Boston the state has incurred an expense of \$1,275,253 more. After allowing for all amounts repaid and to be repaid, the state has thus far spent a little over three millions, and the combined expenditure of all parties in the six years amounts to over \$11,300,000. The amount available from the state treasury for expenditures on this account in 1898 will be about \$2,435,000.

The Commissioners renew their suggestion of last year that the New York, New Haven & Hartford ought to take a lease of or consolidate with the New England road in order to promote the interests of the public and of the two roads; they also "venture to suggest" that the New York, New Haven & Hartford adopt a shorter title and one of less provincial import.

The report describes at length the arrangements for a new station at Dartmouth street, Boston, which will have to take the place of the present terminal station of the Providence Division of the New Haven road when the new southern Union station is put in use. The New Haven road has made plans for an overhead station, which, it appears, have been approved by the Commissioners, but the Boston & Albany seems to have taken no action, and according to the terms of the law that company can, if it choose, build a separate station near Dartmouth street without consulting the Commissioners.

The report contains the usual review of the bridge work done by the railroads during the year, prepared by Prof. George F. Swain, the Bridge Engineer to the Board. It is now 10 years since the bridges of the state have been systematically inspected, and Mr. Swain reviews his work for that period. In 1867 the total length of iron bridges in the state was only 651 ft. In 1877 it was 11,700 and in 1879 it was 13,823. There are now in the state 495 wooden bridges, with a total length of 59,178 ft.; 249 stone bridges, 5,797 ft., and 1,081 iron bridges, 54,894 ft. The maximum weight of locomotives in Massachusetts in 1873 was 35 tons; in 1883 it was 51 tons; in 1887 60 tons and in 1897 73 tons.

Ohio Railroad Commissioner's Report.

The State Railroad Commissioner of Ohio, Raymond S. Kayler, has issued the 30th annual of his office. The first part of the report deals with orders issued by the Commissioner during the year, of which there have been 435. Over 300 of these were approvals of plans for hanging overhead telephone wires; 35 concerned crossings and 24 were approvals of fire extinguishers for passenger cars. The Commissioner has reminded the railroads of their duty to promptly comply with the law requiring automatic couplers on freight cars. The law requiring frogs and switches to be blocked is also being looked after. The yards of all the roads in the state are being inspected. Twenty-eight roads report that they are fully equipped with blocks and others intend to act soon. Thirty-one roads have supplied fire extinguishers for cars as required by law. The Commissioner believes that this law will soon be fully complied with.

The Commissioner recommends a law prescribing the size of poles for electric wires, with other suitable regulations. The report shows the costliness of grade crossings of one railroad with another, and the Commissioner thinks that these crossings ought to be abolished as soon as possible.

Thirteen passengers, 93 employees and 285 other persons were killed on the railroads of the state during the year, and 165 passengers, 2,720 employees and 502 other persons were injured.

The Inspector attached to the Commissioner's office, Mr. J. C. Morris, makes a report of his physical inspection of seven roads and of informal or partial inspections at various other places. The inspector thinks that frogs and guard rails will be much better blocked hereafter, "on account of the many new safety devices which have been introduced" for this purpose. Notes are given of the inspection of interlocking switches and signals. In several cases a note is made to the effect that the apparatus needs adjustment. In one case the note reads "good, except distant signal not working." The inspector gives notes of three locomotive boiler explosions, but in two of them he was "unable to determine the exact cause," and in the third the boiler "was in good condition, as far as could be ascertained."

This would seem to indicate that the inspections are superficial, and the same remark applies to the inspections of the two failures of pile bridges, which are briefly noted.

The report gives three pages of statistics made up from the annual reports of the railroad companies. The totals are given in two columns headed "Entire Line" and "Proportion for Ohio." The basis on which the second column is calculated is not given, but the principal items are as follows:

Miles of road.....	8,730
Stock.....	\$371,353.57
Bonds.....	341,155.570
Cost of road.....	700,388,997
Earnings.....	60,899,603
Earnings 1896.....	74,730,717
Operating expenses.....	44,629,034
Operating expenses, 1896.....	49,790,535
Income.....	16,270,574
Income, 1896.....	24,929,172
Employees.....	61,435
Employees, 1896.....	58,628
Averages:	
Stock and bonds per mile.....	\$81,940
Cost of road per mile.....	79,770
Earnings per mile.....	6,976
Receipts per passenger per mile, cents.....	1.5
Receipts per ton per mile, cents.....	0.5

The great decrease in earnings from 1896—from 75 millions to 61 millions—is so large as to make one suspect the accuracy of the figures, especially as the number of employees increased nearly 3,000, and the receipts per ton per mile for freight decreased only one mill.

The Buffalo Wheel and Axle Tests.

A series of tests on wheels and axles of special quality was made Jan. 21 by the New York Car Wheel Works and the P. H. Griffin Machine Works under the auspices of the Central Railway Club and in the presence of about 100 railroad officials from the Middle and Eastern States and Canada. Representatives of the railroad papers were also present.

The tests were made under the supervision of the committee appointed by the Central Railway Club at its November meeting, the committee consisting of Mr. A. C. Robson, Division Master Car Builder of the Lake Shore & Michigan Southern; Mr. J. A. Bradley, General Foreman Car Department of the New York, Chicago & St. Louis, and Mr. Robert Potts, Division Master Car Builder of the Michigan Central, St. Thomas, Ont.

Chilled wheels of special quality and design were submitted to the tests required in the different European countries for steel wheels, thus:

Austrian State.—Wheel placed upright on heavy iron and stone foundation. Weight of 475 lbs. dropped from varying heights, commencing at one meter (about 3¼ ft.), and increasing by half meters to six meters (about 19½ ft.). Wheel must stand eight blows in all. Test will be continued until wheel is broken.

German State.—Wheel placed horizontally on heavy iron and stone foundation. Tapering steel wedge placed in bore. Weight of 475 lbs. dropped from varying heights, commencing at 1½ meters (about 5 ft.), and increasing by half meters to four meters (about 13 ft.). Wheel must stand six blows in succession without bursting. Test to be continued until wheel is broken.

French State.—Wheel placed upright on heavy iron and stone foundation. Weight of 2,200 lbs. dropped from a height of 4½ meters (about 14½ ft.). Wheel must stand three blows without breaking. Test to be continued until wheel is broken.

Also tests required by American railroads for cast iron wheels.

Master Car Builders.—Wheel placed horizontally on heavy iron and stone foundation. Weight of 140 lbs. dropped from a height of 12 ft. on hub. Required to stand five blows. Test to be continued until wheel is broken.

Pennsylvania Railroad Thermal.—Wheel laid flange down in the sand and a channel-way an inch and a half wide and four inches deep moulded with green sand around the wheel. This channel-way will then be filled with molten cast-iron; two minutes later an examination of the plates will be made. Wheel to be accepted, must not be broken in pieces, and the cracks in the plate, if any, must not extend through the tread.

Bursting.—An axle having wheel seat turned with offsets increasing by one sixteenth of an inch, will be forced into the bore of a wheel by the hydraulic press. There will be five offsets which will increase the diameter of the wheel seat by 5/16 inches over diameter of wheel bore, and pressure will be recorded for each offset. Test will be continued until wheel breaks.

Also tests on axles of standard and special qualities.

Test No. 1.—The ends of a cold rolled axle will be supported, and pressure brought to bear at the center to bend it out of line and it will then be allowed to spring back. The pressure for each deflection and the permanent set, if any, will be recorded.

Test No. 2.—Same as test No. 1 on ordinary steel axle of the same diameter, and Master Car Builders' specification. **Test No. 3.**—A 4-in. cold rolled axle, 6 ft. 5 in. in length, of the special quality furnished for electric service, will be bent cold in the hydraulic press until the ends are brought together. An examination will then be made to see if any cracks appear at the bend.

The results of the tests were as follows:

33-in. diameter wheels made to Austrian State Railway specifications. Weight, 800 lbs. Wheel to stand 8 blows.—1st to 9th blow, no effect; at 9th blow small crack in tread 4 in. long, gradually extending to 12 in.; at 12th blow; 13th to 18th blow, no change; 18th to 21st blow, crack extended to plates; 21st blow, crack extended through both plates around hub to tread on opposite side; 22d blow, wheel broken into two pieces; chill, ¼ and ¼ in.

Austrian-Hungarian test applied to 33-in., 650-lb. wheel Pittsburgh, Bessemer & Lake Erie specifications for 100,000, pounds capacity cars.—1st to 7th blow, no effect; 7th to 15th blow, small cracks developed and extending through tread, and plates; 16th blow, wheel broken into two pieces; chill, nine-sixteenths and ten-sixteenths inches.

Under the Austrian State Railroad test the wheel was required to stand eight blows in all without being broken in pieces. It will be seen that in the first test given above the wheel stood eight blows without effect.

Under the German State Railroad test the wheel tested was 33 in. in diameter; weight, 650 lbs. Master Car Builders' specifications for American railroads.—1st to 14th blow, no effect; 14th to 18th blow, crack extended through hub and plate; 16th blow, wheel broken into two pieces.

On this test the wheel is required to stand six blows in succession before being broken into pieces, and the wheel tested stood thirteen blows with no effect.

French State Railroad test applied to 33-in., 650-lb. wheel, Lake Shore specifications for locomotive tenders. Wheel must stand 3 blows.—1st to 6th blow, no effect; 6th blow, crack 8 in. long in throat, parallel to flange; crack through rim of wheel at bottom to single-plate; wheel unbroken and test discontinued.

* Pennsylvania Railroad requires 12 blows. Lehigh Valley Railroad requires nine blows.

Belgian State Railroad test applied to 39-in. wheel; weight 900 lbs. Grand Central Railroad of Belgium specifications. Wheel must stand blows.—First to 7th blow, no effect; 8th blow, wheel broken into two pieces; chill, eleven-sixteenths and three-quarters inches.

Master Car Builders' test on 33-in. wheel; weight 600 lbs. Wheel must stand five blows.—First to 26th blow, no effect; 27th blow, small crack in bottom plate; 28th blow, crack extended to a length of 8 in.; 28th to 47th blow, no change; 48th blow, crack through flange; 49th to 85th blow, cracks gradually extending; 86th blow, wheel broken into two pieces; chill, nine-sixteenths and five-eighths inches.

Pennsylvania Thermal test: wheel tested 33 in. in diameter; weight, 600 pounds. Pennsylvania Railroad specifications.—The molten band one inch and a half wide and four inches deep was cast in fourteen seconds and the wheel stood the test without failure of any kind.

Bursting test.—Axle with five off-sets was forced to the maximum pressure of a hundred ton hydraulic press into the bore of a 33-in., 650-lb. Pittsburgh, Bessemer & Lake Erie wheel, with no effect on the wheel. The axle at its largest diameter was five-sixty-fourths of an inch larger than the bore of the wheel into which it was pressed.

Tests of Axles of Standard and Special Quality.

Special cold rolled axle, three and three-eighths inches diameter, resting on supports six inches apart, was pressed out of line one-quarter of an inch and allowed to spring back. No effect. It was then pressed out of line one-half inch and pressure released. No permanent set. It was then pressed out of line three-quarters of an inch and pressure released. No permanent set. It was then pressed out of line one inch and pressure released. Permanent set one-eighth of an inch. The result of this test showed that a special axle would withstand a blow that would bend it three-quarters of an inch, without the slightest effect in the way of a permanent set or bending.

A similar test was then applied to a standard steel axle, Master Car Builders' specifications, for fifty thousand pounds capacity cars, diameter four and a half inches in center at smallest point. The axle was pressed out of line one-quarter of an inch and allowed to spring back. No effect. It was then pressed out of line one-half inch and allowed to spring back. Permanent set one-sixteenth of an inch. It was then pressed out of line three-quarters of an inch and pressure released. Permanent set one-eighth of an inch. It was then pressed out of line one inch and pressure released. Permanent set five-eighths of an inch.

Another test then followed with a special quality cold-rolled axle, which was bent one inch out of the straight line in the center and pressure released. Permanent deflection one-sixteenth of an inch.

Test of special quality cold-rolled axle 1 in. in diameter, 6 ft. 5 in. long. This axle was bent cold under the hydraulic press until the ends were brought together. No defects of any kind appeared. The special feature of this test was that it was made on exactly the same quality axle as was subjected to the tests for bending and deflection, indicating that the strength and toughness were equal to the elasticity of the axle. A sample of a similar quality axle was exhibited, which had a mileage of 120,000 miles with less than one-thirty-second of an inch wear.

The intention of the axle test was to demonstrate the elasticity, toughness and wearing qualities of the material of which the axles were composed. The workmanship of these axles was of a superior quality, the axles being guaranteed true to the three-thousandths of an inch.

These axles are primarily intended for electric service, where the highest qualities of strength and resistance to wear are required, but they are also recommended for the highest grade steam service.

In addition to the tests referred to, The P. H. Griffin Machine Works and the New York Car Wheel Works were thrown open throughout to the visiting officials, and the process of manufacturing and finishing wheels was inspected in every detail from the smelting of the iron to the completion of the finishing work. The methods followed by the New York Car Wheel Works in their daily manufacture, whereby the quality of every wheel is positively assured before delivery for service, were also explained. The laboratories and testing rooms for the strength and wearing qualities of the wheels were also visited and tests were made from the preceding day's work to explain the methods followed. A large exhibition was also made of wheels for electric railroads at home and abroad.

An exhibition was made of the special qualities of charcoal iron used in the manufacture of the special wheels tested, and by means of which it is possible to attain the exceptional results obtained on the tests. Samples of wrought iron, both finished and unfinished, were also exhibited, made from the special iron referred to, also samples of different high-grade alloys used in the process of manufacture.

It must be understood that the European tests used are intended for steel-tired wheels only, and in erecting the necessary testing machinery and subjecting chilled wheels to such severe tests, it was the intention to prove that chilled wheels could be made equal to, if not superior in strength and wearing qualities, to any make of steel-tired wheels that could be found, and at less than one-third the cost. The chilled wheel possesses the unusual feature of having a scrap value of about 50 per cent. of its original cost.

Proposed Legislation.

Senator Cullom has introduced in Congress an entirely new bill for amending the Interstate Commerce Law. It gives the Commission absolute authority to enforce the long and short haul clause of the law, revises the requirements for filing and publishing joint tariffs, and empowers the Commission to fix rates where they are unreasonable. Nothing is said about pooling.

From the House Committee on Interstate and Foreign Commerce, majority and minority reports on the anti-scalping bill have been presented. The majority report favors the passage of the bill, with amendments providing a penalty for failure to redeem, and making it unlawful for a general ticket agent to supply tickets to any other than authorized agents. The minority report, which is made by Congressman Mann, of Illinois, and Adamson, of Georgia, declares that the bill will not accomplish its ostensible purpose, and that its provisions are uncertain and defective. Mr. Mann expatiates on the curious anomaly of the railroads seeking to prevent other people fixing rates lower than the rates fixed by themselves. The bill is now on the House calendar.

The House has passed a bill extending the homestead laws to Alaska and providing for right of way for railroads in that territory. The bill grants the right of way through the territory to any railroad company organized under the laws of any state or territory or by Congress. Two companies, one in New York and the other in Philadelphia, desire this grant.

Senator Pettigrew, of South Dakota, has introduced in Congress a bill requiring railroad officers to report all train accidents to the Interstate Commerce Commission, under penalty of \$100 or more. Congressman Eddy has introduced a bill forbidding the Interstate Commerce Commission to extend beyond Jan. 1, 1901, the time for equipping freight cars with automatic couplers and continuous brakes. Mr. Sullivan, of Mississippi, has introduced a bill to compel railroads to accept any ticket from any person, non-transferable tickets being outlawed.

A bill has been introduced in the New York Legislature providing that railroads in New York and Brooklyn, which have in the past or may in the future elevate or depress their tracks, shall not lose any rights which they have to the surface of the streets through which the lines run. Such a law would apply principally to the New York Central, in Park avenue, between 106th and 135th streets, and to the Long Island Company, in Atlantic avenue, Brooklyn. In the last-mentioned case no change has yet been made, but the depression of the tracks now lying on the surface is under contemplation and will have to be made in the near future. It is believed that the bill was presented in the interest of the Long Island road. There is also a bill to extend the life of the franchise of the New York & New Jersey Tunnel Co., which is the Long Island Railroad organization to connect the Atlantic avenue line with Manhattan Island by a tunnel under the East River, terminating at the corner of Cortlandt and Church streets. The charter as it now stands gives a franchise for only 25 years, but the expenditure necessary to make the tunnel will be so large that the tunnel company is reluctant to make the investment except upon assurance of a franchise for a longer term.

In another batch of bills laid before the New York Legislature is one empowering each member of the Legislature to visit and inspect any public building or institution and incidentally authorizing him to ride free in any drawing-room, sleeping or other car when going to or from such public institution. This childlike scheme for "beating" the constitution of the state makes the railroad company guilty of a misdemeanor, if it refuse to honor a legislator's certificate. Among the numerous other railroad bills introduced at Albany are one prohibiting the display of advertisements in elevated railroad cars in New York City, one limiting to five cents the fare on all railroads within the limits of New York City, and one making mileage ticket coupons acceptable on trains.

A bill has been introduced in the Ohio Legislature requiring all steam railroads 10 miles or more in length to have a telegraph or a telephone line, under penalty of fine and imprisonment for disobedience of the law. It is said that the bill is introduced by a member who lives on the line of the Cincinnati, Portsmouth & Virginia.

In the New Jersey Legislature a bill has been introduced to establish a State Railroad Commission. The Virginia House has passed a bill making railroad corporations responsible for injury or death to any employee by accident, whether the accident be due to a fellow-servant's carelessness or not.

TECHNICAL.

Manufacturing and Business.

The wire trust is receiving a great deal of attention by the newspapers. This time it is reported that the Secretary of State of Illinois has not as yet issued the license to incorporate the American Steel & Wire Co., with its capital of \$87,000,000. The reports also state that a New York syndicate, headed by J. Pierpont Morgan, will control about two-thirds of the entire capital stock. The statements further say that the combination at present has contracts to take up two plants at Joliet, two at Pittsburgh, two at Worcester, one at Waukegan, one at Cleveland, one at Allentown, Pa., one at St. Louis and one in Kansas.

The following officers were elected for the ensuing year at the annual meeting of the Oil City Tube Works at Oil City, Pa.: D. O'Day, President; E. J. Geary, Vice-President; Geo. S. Oberly, Secretary and Treasurer. Directors: Joseph Seep, John A. Geary, E. E. Seep.

The La Belle Iron Works, of Wheeling, W. Va., have recently installed two electric traveling cranes manufactured by Pawling & Harnischfeger, of Milwaukee, Wis. The larger one is of 20 tons capacity and has a span of 50 ft. The other one has a capacity of five tons and a span of 75 ft.

The Crandall-Kinney Railway Supply Co., of Chicago, Ill., has been incorporated by Dwight K. Tripp, Henry T. West and Wm. H. Rich, with a capital stock of \$10,000.

It is rumored that a syndicate will purchase the plant of the Cofrode & Saylor Bridge Works, located at Pottstown, Pa., and will put it in operation. The works have been idle for some time.

The General Electric Co., of Schenectady, N. Y., has under consideration plans for a large iron foundry, but nothing definite has yet been decided on.

At the awarding of the contracts for the machinery for the new car shops of the John Stephenson Co., at Elizabeth, N. J., recently, J. A. Fay & Co., of Cincinnati, O., were given orders for 26 machines out of the 30 awarded. They were also awarded the contract for all the wood-working machinery for the Lima shops of the Cincinnati, Hamilton & Dayton. This firm has recently equipped the car shops at Sormova, Siberia and Psever, Russia.

The Eagan Company, of Cincinnati, O., has just made a shipment of 12 car loads of woodworking machinery to the Russian Government, St. Petersburg.

The annual meeting of the stockholders of the Pyle National Electric Headlight Co. was held on Wednesday, Jan. 12, and the following Board of Directors was elected for the ensuing year: R. C. Vilas, Perry Trumbull, George C. Pyle, A. J. Cooper and E. J. Maturin.

The American Signal Co., of Baltimore, Md., was incorporated Jan. 18, 1898, by Henry E. Wilkins, John W. Buck, Robert Diggs, Thomas C. Murray and Richard O'Toole. The new company is a reorganization of the American Signal Co., which was in existence for about seven years, and made the American road crossing signal. Hiram M. Buck, who was connected with the old company, will be Secretary and Acting General Manager of the new company.

It is reported that the Pittsburgh & Western has awarded to Arthur Seaton, of Mercer, Pa., the contract for its tie supplies for 1898.

It is rumored that the Cummer Lumber Co., of Baldwin, Fla., will shortly buy 25 miles of rails.

The Simplex Engine & Machinery Co. has been incorporated at Chicago by F. W. James, J. Francis Small and W. D. Sherwood, to manufacture engines and refrigerating apparatus. The capital stock is \$20,000.

The Bourgeois Motor Works, of New Orleans, La., is in the market for milling machines, planers, key-seaters, shapers, lathes for turning and boring balance wheels.

The Imperial Government Railways of Japan have placed an order with the Carnegie Steel Co., Ltd., for 30 miles of 20-lb. rails.

At the annual meeting of the stockholders of the Conowingo Bridge Co., held Jan. 5, the following officers were elected for the ensuing year: Philip T. Bell, President; James S. Patterson, Secretary. Directors: Jacob Tome, J. S. Patterson, J. W. Bell and R. B. McCoy.

Last week we noted that an application for a charter of incorporation had been made by J. & J. B. Milholland Co., of Pittsburgh, Pa. They were chartered Jan. 24 with a capital stock of \$5,000. James Milholland, Pittsburgh, President.

The Ferro-Carbon Casting Co., of Philadelphia, was chartered Jan. 24 with a capital stock of \$50,000, to make the castings of the Atlas Steel Converting Co., and to do a general foundry and machine business. The Directors are: John Hoskins, President, Philadelphia; Samuel Hufty, Camden, N. J.; J. K. Caldwell, Alfred C. Rex, Philadelphia, and C. A. G. Riege, Ambler, Pa.

Peter D. Wanner, of Reading, Pa., and Geo. Harrison, of Birdsboro, Pa., were appointed Receivers of the Reading Foundry Co. The assets amount to \$360,000 and the liabilities aggregate \$250,000. The January, 1898, interest on the second mortgage bonds was defaulted. Operations will continue.

Articles of incorporation have been filed at Trenton, N. J., for the Brass Foundry & Machine Co. of Jersey City. The company will operate foundries for iron, steel and brass castings. The incorporators are: Adolph Zimm, Wm. S. Laporte, Michael Gagin, Jr., of New York; Rudolph Gutman, of Greenville, N. J., and Francis P. McManus, of Jersey City, N. J.

The Dayton Furnace & Foundry Co., of Dayton, O., filed the necessary papers with the Secretary of State to change its name to the Progressive Furnace & Foundry Co. and its place of doing business to Springfield, O.

The Lehigh Valley Construction Co., of South Bethlehem, Pa., on Jan. 17 filed in the St. Lawrence County Clerk's office, at Canton, O., a deed of general assignment to Julius Workum, of New York. The company had a sub-contract from the St. Lawrence Construction Co. to do the work on the Massena (N. Y.) canal for the St. Lawrence Power Co. The Lehigh Valley Construction Co. has filed a mechanic's lien against the Power Company for \$53,000, claiming to have done \$78,000 worth of work during the past summer, for which it has received \$25,000 only.

John Wood, Jr., of the Schuylkill Foundry & Machine Works, Conshohocken, Pa., is now making shipments to foreign ports of Wood's water-tube boilers, with all castings and fixtures, one shipment going to England and one to Transvaal. He has just received orders for shipments to the Sandwich Islands and to Alaska.

Ground has been broken at Allegheny, Pa., for the plant of the new Pennsylvania Car Wheel Co. It is expected that the building will be finished by the end of March.

Iron and Steel.

The Maripol-Nizopal Iron & Steel Co., of Maripol, Russia, has engaged for five years the services of H. Kennedy, former Superintendent of the 32-in. mill at the Homestead Steel Works, Pa., as General Superintendent of its blast furnaces.

The personal property of the Valentine Iron Co., of Bellefont, Pa., was purchased at sheriff's sale for the

preferred creditors for a sum slightly in excess of \$10,000 by C. M. Bower. It is stated that the real estate of the company will be sold in April.

At the annual meeting of the Cambria Iron Co., held in Philadelphia, the following officers were elected: Powell Stackhouse, President; J. W. Townsend, Vice-President; J. Lowber Welsh, Second Vice-President; W. T. Roberts, Secretary and Treasurer; Alexander T. Robinson, Assistant Secretary and Treasurer. Directors: Josiah M. Bacon, Robert S. Kennedy, Charles S. Price, David Reeves, Powell Stackhouse, Edward T. Stotesbury, John W. Townsend, John Lowber Welsh and R. Francis Wood.

The Bethlehem Iron Co. has been awarded a contract by the United States government to forge, finish and mount 15 4-in. rapid firing guns for the navy. This is the first contract awarded to any one concern for the entire manufacture, finish and mounting of the guns. On other contracts the company forged the guns, which were afterward finished and mounted at other establishments.

The Old Meadow Rolling Mill Co., of Scottdale, Pa., elected at its annual meeting the following officers and Directors: President, John Parker, Scottdale; Secretary, P. F. McCann, Greensburgh; Treasurer, A. B. Pickard, Scottdale. Directors, James A. Bennett, Greensburgh, A. L. Keister, A. C. Overholt and N. A. McCombs, Scottdale; R. K. Hissem, Mt. Vernon. This company has recently made contracts for equipping its new mill. The Lane & Bodley Co., of Cincinnati, O., are to supply the engines to run the rolls. The Frank Kneeland Co., of Pittsburgh, will furnish the rolls and the Lloyd-Booth Co., of Yongstown, O., will put in the squaring shears and the roll lathe. The General Electric Co., of Schenectady, N. Y., has furnished an engine and electric generator for the crane.

It is reported that the Laramie Rolling Mills have received a contract from the Oregon Short Line for 3,000 tons of 72-lb. rails, to be used for replacing 52-lb. rails.

The No. 3 furnace of the Brook Iron Co., located at Birdsboro, Pa., which has been idle for a year, has been put in blast.

The Douglas and Sharon furnaces, which have been idle for three years, will soon be put in blast.

The Lebanon Iron Co., of Lebanon, Pa., on Jan. 21 elected these Directors: J. M. Schenk, President, Secretary and Treasurer; C. W. Wilhelm, Grant Weidman, G. D. Rise, A. Hess; Thomas Evans, Superintendent; Herbert Hecht, Assistant Superintendent.

At the annual meeting of the stockholders of the Columbia Iron Co., of Columbia, Pa., the following Directors were elected: B. Frank Conner, William Harm, C. C. Kaufmann, J. C. Forry, Hiram Wilson, Milton Wike and Jos. W. Yocum. The following officers were elected: President and General Manager, C. C. Kaufmann; Secretary and Treasurer, Jos. W. Yocum.

It is reported that propositions have been made to the Board of Trade of Wellsville, O., by Niles, O., and Sharon, Pa., capitalists, who want to locate a large iron mill at Wellsville.

F. L. Grammer, who took charge of the Colebrook and Bird Coleman furnaces, located at Lebanon, Pa., and Cornwall, Pa., respectively, for the Lackawanna Iron & Steel Co. of Scranton, Pa., has made arrangements to remove the main office now at Colebrook furnace to Bird Coleman furnace, which has just been put in blast after an idleness of more than a year and a half.

At the Philadelphia Bourse, the Mahoning rolling mill property, consisting of seven pieces of land, with shops, etc., located at Danville, Pa., was sold at auction. It was knocked down to R. K. Polk, of Danville, for \$30,200.

At a meeting of the stockholders of the P. L. Kimberly Iron Co., held at Sharon, Pa., on Monday, Jan. 17, the following Directors were elected: P. L. Kimberly and Alex. McDowell, Sharon, Pa.; Geo. G. Stage, Greenville, Pa.; Alex. W. Thompson and Thomas W. Phillips, Jr., New Castle, Pa.

The Cincinnati, New Orleans & Texas Pacific has purchased 3,000 tons of rails from the Carnegie Steel Co., Ltd., and 3,000 tons from the Cambria Iron Co.

A charter was taken out at Harrisburg on Jan. 18 by the Mahoning Ore & Steel Co., of Philadelphia; capital \$5,000. The President is Powell Stackhouse, Wallingford, Pa. The Directors are: J. W. Townsend, J. M. Bacon, R. F. Kennedy, Alex. P. Robinson, Wm. S. Robinson, W. A. Sproul and Walter S. Ottinger. All but last-named three are Directors or officers of the Cambria Iron Co.

At the annual meeting of the Commonwealth Iron Co., of Cleveland, the following officers were elected: President, E. W. Oglesbey; Vice-President, E. H. Harvey; Treasurer, John Whitelaw; Secretary, C. W. Merrill.

It is announced that the directors of the Illinois Steel Co. have authorized the immediate erection of a new slabbing mill at the South Chicago Works, designs and specifications for which were completed some time ago. It is said that the new mill will be thoroughly modern in plan and equipment and that it will cost about \$400,000.

New Stations and Shops.

Western newspapers have recently contained reports to the effect that a new passenger station will be built at La Crosse, Wis., by the Chicago & Northwestern

Railway Co. The truth of the matter is that the road is simply putting up a shed connecting the depot proper with the baggage room.

The Des Moines Union Railway has now a proposition pending before the City Council of Des Moines, looking to the closing of some streets and alleys, with the view of building a Union Passenger Station. If the station is built it will be occupied by the Wabash, the Des Moines, Northern & Western, over which the Chicago, Milwaukee & St. Paul do business into Des Moines, and the Chicago & Great Western, and probably some of the other roads in Des Moines, which have at present very poor facilities, will embrace the opportunity to improve their location by using the station. The plans have not yet been worked out, owing to the fact that the ordinance has not yet been passed.

The Burlington is considering spending about \$25,000 or \$30,000 in consolidating the terminals, which are now occupied at Kansas City by the Hannibal & St. Joseph and the Kansas City, St. Joseph & Council Bluffs, in different locations; but there has been nothing definite decided upon.

The new Atchison, Topeka & Santa Fe station and hotel at Dodge City, Kan., is now complete and open to the public. The formal opening will be held Feb. 22.

The Pennsylvania is remodeling its big boiler house at the Altoona shops, building a 75-ft. brick extension to the southwest end, which will more than double its present size. The number of boilers will be increased from 6 to 10. The dynamo room will be rebuilt and enlarged and one or two new dynamos installed. A portion of the flue shop will be cut off and an extension built to the other end. The new 60-ton cranes for use in the erecting shop will arrive shortly. The improvements will not be entirely completed before Sept. 1.

On account of the number of articles which have recently appeared in daily papers in regard to changing the location of the Union Depot at Kansas City, Mo., the Executive Committee of the Union Depot Co. issued a statement, the main points of which are given below. When the present depot was built, a contract was made for 50 years from the time of the opening of the station, which was in April, 1878, under which each company using the station is obliged to run all its passenger trains to and from that station. While at times the present Union station is crowded, the location is the most desirable for the majority of the roads and for a very large part of the city. In view of this fact, as well as the contract, it is difficult to see how any change can be made in location. The attention of the Directors is now being given to improving the service and facilities in every way practicable.

It is reported that the Pennsylvania Company has brought injunction proceedings against the city of Lima to prevent it from issuing \$98,000 bonds for the purpose of securing the Lima Northern shops and an enlargement of the Cincinnati, Hamilton & Dayton shops. The bonds were issued for park purposes and the Pennsylvania Company, as a taxpayer, is going to prevent them from being used for any other purpose.

The Pennsylvania is now receiving estimates on the new ferry terminal at the foot of Market street, Philadelphia. The structure will be of iron and wood, with a frontage of 527 ft., and will extend into the Delaware River 152 ft.

Government Armor Plate.

On Jan. 19 Secretary Long appeared before the Senate Committee on Naval affairs and stated that the Navy Department had prepared full plans and specifications calling for an armor plant, in accordance with the last naval appropriation bill, and that estimates on the cost of land, tools and machinery had been made, the bids to be opened on Jan. 29. He also stated, in view of the report of the committee which he had appointed to consider the question of the government armor plant, that on account of the great cost and delay it would involve, he had entered into further negotiations with private armor plants, and he believed that he could make a contract for the supply of armor plate for the Illinois, the Alabama and the Wisconsin, now under course of construction, at the rate of \$400 per ton. He recommended, in view of the circumstances, that an arrangement to this effect should be made. From the Secretary's statement it appears that the cost of the government plant properly equipped would be about \$4,000,000, and that it would be three years before armor could be turned out from the plant.

Japan's New Cruisers.

The Japanese cruiser Kasagi was launched at the yards of the Wm. Cramp & Sons Ship & Engine Building Co. on Jan. 21. This is the most important ship ever built in the United States for a foreign country and is the first foreign warship launched in America since the Russian vessel Zobia, in 1873. The dimensions of the Kasagi are: Length, 374½ ft.; beam, 48¾ ft.; depth, 30 ft.; mean draft, 17 ft. 9 in., with a displacement at that draft of 4,900 tons. In the specifications she is classed as a protected cruiser of the second class, relying on her coal bunkers, which run 103 ft. fore and aft of her amidships section, to protect her engines, which are entirely below the water-line. Above this is a protected deck, having a maximum thickness of 4¼ in. on the slopes and 1¾ in. on the flat. She has twin screws, driven by two vertical triple-expansion four-cylinder engines, estimated to develop under forced draft a mean speed of 22½ knots per hour. The engines are 17,000 H. P. Steam is supplied by 12 single-

ended boilers, 14 ft. 2 in. in diameter and 9 ft. 9 in. in length. She is mounted with two 8-in. rifles and ten 4½-in. quick-firing rifles, twelve 12-lb. quick-firing rifles and six 2½-in. Hotchkiss guns. When the vessel is handed over to the Japanese government, five torpedo tubes, 14 in. in diameter, will be mounted. There are two steel masts, provided with fighting tops, in which rapid-firing guns will be placed. She will be equipped with four search lights and there will be eight steering stations. A sister ship to the Kasagi, the Chitose, was launched Jan. 22 from the yards of the Union Iron Works at San Francisco, Cal.

Speed Experiments on the Berlin Stadtbahn.

The Mechanical Inspection Bureau of the Royal Railroad Department in Berlin has constructed a simple and ingenious apparatus for determining the actual speed of the Stadt and Ringbahn trains between any two stations. In one compartment of a car was placed an ordinary Morse recorder which was supplied with current from a battery, and connected with a make-and-break contact on the car axle. This contact was so arranged that the current was interrupted at every half revolution of the axle. The resulting Morse record strip, on which every revolution was shown by breaks in the line, gave a mathematically exact picture of the movement of the train. The results were shown in curves at the Verein für Eisenbahnkunde at Berlin, first for an ordinary run and then for a forced run, where the locomotive was pushed to the utmost.

New Boat for the Cape Charles Route.

The New York, Philadelphia & Norfolk Railroad has contracted with the Delaware River Iron, Ship Building & Engine Works for building a passenger steamer to ply between Cape Charles City and Norfolk. The boat will be 230 ft. in length, 41-ft. beam, 15-ft. depth of hold and will carry 250 passengers and 250 tons of baggage and express, with a draft of 9½ ft. She will be driven by a screw propeller, the cylinders of her engines being 19, 32 and 50 in. in diameter by 8-in. stroke. Steam will be furnished by two boilers 13 ft. in diameter, with a working steam pressure of about 170 lbs. She will be called the "Cape Charles."

THE SCRAP HEAP.

Notes.

The trains of the Pennsylvania Lines now run to and from the Union depot at Toledo.

The Delaware & Hudson Canal Company's Railroad has discontinued suspensions, adopting the Fall Brook discipline on Jan. 1.

Of the 1,400 miles of main track in the Northwest System of the Pennsylvania Lines West of Pittsburgh, about 800 miles, or 57 per cent., is now ballasted with broken stone.

A resolution has been adopted in the Senate at Washington calling upon the Committee on Commerce to investigate the funds and the penalty clauses of the Joint Traffic Association. The resolution was introduced by Senator Chandler.

Press dispatches from Omaha report that the new management of the Union Pacific has bought 40 acres of land in that city, near the grounds of the Trans-Mississippi Exposition, and that most of the freight work now done at Council Bluffs will be transferred to Omaha.

At a hearing in Boston the other day one of the State Railroad Commissioners said that in a period of 14 months, ending with February, 1897, there were reported to the Commissioners over 400 cases in which electric cars were accidentally stopped on crossings of steam railroads.

A fire at East St. Louis on the night of Jan. 25, during a very high wind, destroyed the Union elevator, several freight houses of the Chicago, Burlington & Quincy, 110 freight cars loaded with wheat and merchandise and 15 dwelling houses. The elevator contained about 1,500,000 bushels of grain. Total loss from \$1,000,000 to \$1,600,000.

Since the election of Mr. M. K. Bowen to the Presidency of the Chicago City Railway employees have been notified that in deciding questions of discipline no account will be taken of demerit marks registered prior to Jan. 1, 1898. This will clear the records of employees who took part in the recent movement to organize a union, and in the threatened strike.

The wind, rain and snowstorm on Jan. 23 did much damage in widely separated parts of the country. In Wisconsin and elsewhere in the West a snowfall of 18 in. was reported, causing serious delays to travel. In the Niagara River the water was very high, owing to the long-continued west wind on Lake Erie. Below Niagara Falls the water was 25 ft. higher than usual and many small structures were submerged. The roadbed of the Gorge Electric Railroad was badly washed in many places. At New Albany, Ind., a railroad trestle was pulled slightly out of position by some barges which had been lashed to it to keep them from floating away, and was so weakened that it fell under the weight of a freight train and there was a bad wreck. Two trainmen were killed and two others injured. The wind on the Ohio River was very high and many coal barges were sunk. At Cincinnati the depth of water was 49.9 ft. The gale was severe throughout Michigan.

New York Canal Improvement Bonds.

State Controller James A. Roberts recently announced that the postponed sale of \$3,230,000 of canal improvement bonds would take place at noon Feb. 18.

These are the bonds which were to have been sold on Jan. 5, but the sale was postponed indefinitely because of a technical error in advertising it, and for the reason that the Comptroller considered it unwise to raise any more money for canal improvement work until the Legislature had decided whether the \$7,000,000 additional which will be needed for the completion of the work should be appropriated. The postponement of the sale was the occasion for the interchange of letters on the canal question by Comptroller Roberts and State Superintendent of Public Works George W. Alridge. Attorney-General Hancock did not believe that the Comptroller could of his own volition stop the sale.

Speed in India.

Really fast running is seldom experienced on Indian lines, but the Calcutta-Bombay Mail, Great Indian Peninsula Railway, made a good run on Saturday, Nov. 20, covering the distance between Kalyan and Byculla, 31 miles, in 30 minutes.—*Indian Engineer.*

B. & O. Improvements at Pittsburgh Completed.

The improvements that the Baltimore & Ohio has been making at Pittsburgh for the past 15 months are now finished with the exception of a small amount of paving between the tracks, which will be done in the spring. This road now has ample yards and facilities at Pittsburgh and sufficient trackage to handle a large business with economy and celerity. The changes cost about \$450,000. They consist of a new yard at Glenwood, five miles out, a double-track trestle nearly two miles long, rebuilding on a new location the main line of the road leading to the passenger station, and the building of new freight yards near the terminus. These improvements were described in the *Railroad Gazette* of Nov. 12, 1897.

Uniform Passenger Train Equipment.

The Illinois Central has issued a circular announcing that it will require all cars offered for movement in its passenger trains to be equipped with air whistle signals, Westinghouse quick action automatic air brakes, and Miller couplers or combination couplers interchangeable therewith, that will not require the use of link or pin.

The Wabash will not accept any car to be hauled in passenger trains unless it is equipped with vertical plane couplers, Westinghouse quick-acting automatic air brakes, and Westinghouse air train signals. The order further specifies that all cars hauled in passenger trains between Chicago and Buffalo must be equipped with steam-heating apparatus.

The Durability of Impregnated Railroad Ties.

According to a determination of the life of impregnated railroad ties, made at the last International Railroad Congress, it was found that on open tracks creosoted pine ties last 15 years, oak ties 18 years, and beech ties 20 years; while the corresponding figures for ties at switches are 5, 7 and 10 years respectively. In general, creosoting gives ties the greatest durability; the best impregnating materials being zinc sulphate and zinc chloride. The impregnated ties suffer less from rot than from mechanical wear at the places where the rails rest. This is shown by comparing the Holland railroad ties treated with zinc chloride with similar ones on some Russian railroad. The former last 15 years, the latter only 7, because these Russian roads do not use rail-chairs and the road-bed contains clay. It follows that the life of ties can be increased by lessening the stresses on the points of support of the rails, either by enlarging the bearing surfaces or by increasing the number of ties.—*Zeitung des Vereins.*

New Bridge Commissioners.

On Jan. 19 the Mayor of New York summarily removed from office the Commissioners of the new East River Bridge, Messrs. Waters, Davis, Thuron, Baird, Sperry and Batterman. The commission was organized in August, 1895, and was appointed jointly by the then Mayors of New York and Brooklyn. Mayor Van Wyck in making the removal and in appointing the new Board of Commissioners alleges as a cause dilatoriness and extravagance of administration. Probably even the Mayor does not take these charges seriously.

The new board consists of Messrs. Lewis Nixon, President; James W. Boyle, Vice President; Smith E. Lane, Secretary; Julian D. Fairchild, Treasurer; John W. Weber and Thomas S. Moore. The Commissioners at once on the day of their appointment formed themselves into two committees as follows: Executive Committee—Commissioners Moore, Weber, Fairchild and Lane, with President Nixon *ex officio*. Finance Committee—Commissioners Fairchild, Boyle, Weber, Moore and Lane.

Erie Canal Investigation.

No less than four canal investigation bills have so far been prepared by New York legislators, and, to judge from the many reports, several other bills are being framed. The first to reach the Ways and Means Committee at Albany, and which that committee has adopted and will report to the Assembly, is known as Governor Black's bill.

It provides for a commission to consist of not less than seven citizens of the state, to be appointed by the Governor within 20 days after the enactment of the bill. They are to examine and report concerning the work already done in connection with the deepening of the Erie, Champlain and Oswego canals under the law of 1895; the contracts made for such improvement, and whether such contracts were properly made; the amount of money actually expended and whether such expenditures were proper; the proportion of the improvement included in contracts already made; the portions of either canal not included in any contract; the amount which will be required to complete the improvement of such canals in accordance with the plans and specifications of the Superintendent of Public Works or the State Engineer and Surveyor. The report is to be made to the Governor in writing on or before June 1, 1898, to be transmitted to the Legislature at the opening of the next session. The Governor may extend the time, but not beyond July 1, 1898. The commission is to have all the powers possessed by a legislative committee, and may employ counsel, engineers and such other assistants as may be deemed necessary. An appropriation of \$10,000 is made.

Public Works in Chicago.

On account of the open winter at Chicago work on the foundations of the new government building is two months ahead of the time estimated by the contractors. The central piers are completed, the piling for the wings is nearly all in and a great part of the foundation is laid. Work on the outer foundation wall was not expected to begin before spring, but indications now point to its completion by that time. It is now expected that if contracts for the superstructure are awarded in April, as it is now thought they will be, the foundations will be ready.

The City Controller of Chicago has received the estimates from heads of departments of the amounts needed to carry on their work during this year. The Department of Public Works asks for \$10,500,440, of which \$6,596,147 is for intercepting sewers, tunnels, pumping stations and pumps. Of the remaining sum asked for

\$1,730,193 is for 18 bridges and four viaducts, the idea being to replace a number of the present center pier bridges with modern lift bridges. As the Controller estimates that the income of the city this year from taxes and license fees will be about \$11,000,000 and the appropriations must be made to fit this sum, the demands of department chiefs for nearly double this amount will have to be heavily scaled down.

The Chicago City Council has created the office of Business Agent. This ordinance in effect enlarges the power of the Purchasing Agent for the Department of Public Works, so as to include all of the departments of the City Hall. The Business Agent is to be appointed by the Mayor with the consent of the Council, give a bond of \$50,000 and receive a salary of \$4,000 a year. He shall report to and be under the supervision of the Controller. In all cases where the amount is less than \$500 he shall let contracts and purchase supplies on requisitions approved by heads of departments; he shall have charge of all stock on hand, purchase all stationery and issue it to the departments on proper requisitions, and all purchases must be made on competitive bids.

In the suit of M. C. McDonald to enjoin the city of Chicago against carrying out the five year garbage contracts recently let and noted in this column at the time, Judge Tuley decided, on Jan. 18, that the contracts were wrongly let and illegal. In an opinion covering all the points raised, the judge gives a decision restraining the city from carrying out the contracts on the ground that in making them for more than one year the city disobeyed the constitutional provision against incurring an indebtedness in excess of five per cent. of the assessed value of its taxable property. The city at once gave notice of appeal. Under the terms of the five-year contracts they were not to go into full effect until March 1, and the six weeks interval was to be filled by an intervening contract by which the five year contractors were to do the work. It has now been decided by the city authorities that this temporary contract shall be carried out until March 1, when the annual appropriation bill will probably be passed, in which provision for the disposal of garbage can be made.

Subjects for the M. C. B. Association.

The Committee on Subjects asks the assistance of members of the Association in preparing its report. It is requested that members will, as soon as possible, send to the chairman of the committee at Williamsport, Pa., a list of subjects which they consider of sufficient importance to be investigated by the committees of the Association. In addition to this information the committee would be glad to have subjects suggested for informal discussion during the convention of 1898. In making suggestions for subjects which are to be reported upon by the committees, it is desired that some thought be given to the subjects which have already received attention at the hands of the Association through various committees. There are undoubtedly some subjects which have been investigated, and which contained all the information necessary at the time for giving a comprehensive view of the same, but on account of changed conditions it might be desirable to have the same subjects investigated further. The committee desires suggestions not later than March 1. The committee are Messrs. E. D. Nelson, Wm. McWood and A. L. Humphrey.

A New Atlantic Freight Steamship.

The new steamship Victoria of the Wilson & Furness-Leyland Line, built at West Hartlepool, England, arrived at New York Jan. 21. The Victoria is 490 ft. long, 52½ ft. beam and 34½ ft. deep. She has capacity for 135 passengers, 8,450 tons of freight and 700 head of cattle. She has one propeller. The cylinders, triple expansion, are 32 in., 54 in. and 90 in. in diameter and the stroke is 66 in.

An Oil Burning Locomotive in Texas.

A Texas paper reports that the Texas Midland has fitted a locomotive to burn petroleum, the intention being to try the oil from the wells at Corsicana, Tex.

Cableways.

"American Cableways" is the subject of a long article in the January number of *Cassier's Magazine*, by Mr. Spencer Miller, M. Am. Soc. C. E. The first practical American cableway was put in use about 1860 in the slate quarries in Pennsylvania, but the most important improvements have been made since 1888. The latest developments have been in the direction of increasing the capacity of the cableway by increasing the frequency of trips, and this has been largely accomplished by means of the aerial dump whereby the load is delivered from the skip automatically; traveling towers are now quite commonly used for such work as the excavation for the Chicago Drainage Canal. Considerable improvement has also been made in the form of the buckets. A bucket has been lately devised which plows up the material to be removed when dragged along the ground; when the bucket is full it is hoisted and conveyed back to the point of delivery where it is automatically dumped. Cableways have been built with single spans up to 1,650 ft., capable of handling loads of 25 tons; the average daily capacity of such a plant has been found to be 1,200 tons of rock when working 10 hours per day. The following limitations are placed on the practicable application of cableways: Single span, 2,000 ft.; load, 25 tons; speed of travel, 1,800 ft. per minute; speed of hoist, 900 ft. per minute. The average practice, however, is about as follows: Span, 600 to 1,200 ft.; load, 3 to 7 tons; speed of travel, 500 to 1,000 ft. per minute; speed of hoist, 150 to 300 ft. per minute.

New Work by the Walker Company.

The Walker Company is now building at its Cleveland works a 1,600-KW. direct-connected generator for the Union Railway Co., of New York. This, with the two of the same capacity now being completed for the Brooklyn Heights Railroad, will make three machines finished in as many months. In addition to the generator for the Union Railway, the Walker Company is building 40 double No. 4-A street railroad equipments. The equipments are to be fitted with the new type S solenoid blowout controller. The current for these motors will be fed to the line from a Walker switchboard, now being built at the New Haven factory. The Metropolitan Street Railway of Kansas City, which is now operated by a 1,600 KW. Walker generator, is about to increase its plant by the addition of a generator of 1,200 KW. capacity.

The foreign shipments during the next few months will include 100 double No. 3 S street railroad apparatus, with 200 controllers, for Dresden, Germany; 6 double No. 3 N equipments, with type S controllers, and two double No. 3-N equipments. Besides these, one 150-KW. belted generator for a railroad with its switchboard and a 75-KW. belted booster for Japan, also with a switchboard. This makes over 7500 H. P. in street railroad motors alone that are being built at the Cleveland works.

Pneumatic Safe Lock for Express Cars.

A patent has been granted to Charles N. Peeter and D. W. Deardorff, of Hagerstown, Ind., for a pneumatic

lock designed to frustrate the schemes of safe robbers. As applied to the lock of a safe in an express car it is to be operated by compressed air from the air brake pipe. The air is admitted to the lock through a valve which controls the action of tumblers inside the lock. Should the air pressure be reduced below a certain point, the valve will open and by so doing release the bolts, which will slip to their place and so lock the safe. Any emergency application of the brake will lock the safe, but applying the air in the usual manner, gradually, will not affect the valve, which controls the movement of the bolts, this result being obtained by the use of a device which may be adjusted to different pressures. From the valve which admits the air to the lock a cord runs throughout the entire length of the train. In case the train is attacked by robbers, and the engineer or any other member of the train's crew has applied the emergency air brake, any passenger on the train by simply pulling the cord connecting with the valve can lock the safe instantly so that it cannot be opened. If robbers know that not even the messenger can unlock a safe, it is expected that their enthusiasm will rapidly evaporate. The inventors say that the lock would also be valuable as a preventive of daylight robberies in banks. With proper pressure pipes, pneumatic, hydraulic, steam or other, clerks in all parts of a bank could be provided with valves so as to lock the safe instantly on the slightest alarm.

Typewriters for Books and Waybills.

The Pennsylvania Railroad now has in use at freight offices in Philadelphia a number of Elliott & Hatch book typewriters, made by the Elliott & Hatch Book Typewriter Co., 253 Broadway, New York City. These machines are adapted to make waybills 21 in. wide and 18 in. from top to bottom, and 10 or more manifold copies can be made at once. In this device some of the main principles of ordinary typewriters are reversed; the paper is fastened on a large fixed platen and the writing point is brought to the paper instead of feeding the paper to the writing point. The writing point moves one space to the right every time a key is struck, and when a line is completed the writing point is spaced down instead of the paper being spaced up.

The machine was devised primarily for printing in books and it is supported on an adjustable frame, so that it can be quickly accommodated to a single sheet of paper or to a thick book, and it works as readily on a small book as on a large one. Letters can be written without taking the book-leaf off the platen. In writing letters the sheet may be superimposed upon the page of an ordinary tissue book, so as to make a carbon copy, thus filling an entire letter book without ever wetting the sheets.

LOCOMOTIVE BUILDING.

The Mexican National is having two simple 10-wheel engines built by the Baldwin Locomotive Works.

The Baldwin Locomotive Works are building one switching engine for the Atlantic Coast Line for March delivery.

The Minneapolis, St. Paul & Sault Ste. Marie has placed an order with the Schenectady Locomotive Works for five locomotives.

The Dora Furnace Co., of Pulaski, Va., has placed an order for one 4-wheel narrow gage switching engine and one broad gage consolidation engine with the Baldwin Locomotive Works.

The Michigan Central is putting new boilers, to carry 180 lbs. steam pressure, on a number of locomotives now having small boilers. The work is being done at the Jackson shops of the road.

CAR BUILDING.

Mr. John Cudahy has ordered, for the Louisville Packing Co., 40 refrigerator cars from the Illinois Car & Equipment Co., in which Bettendorf bolsters are specified.

The Mobile & Ohio order for 200 cars with the Mt. Vernon Car Co., referred to in our last issue, is for 100 box and 100 fruit express cars. They will be of 60,000 lbs. capacity and equipped with New York air brakes, Gould couplers and Mt. Vernon Car Co.'s wheels.

The Southern Pacific has placed an order with the Ensign Mfg. Co. for 500 box cars, 34 ft. long. They will be equipped with Westinghouse air-brakes, Janney couplers, Wagner car doors and Winslow galvanized roofs, the last-named to be made by the Ensign Mfg. Co.

In our last issue we noted the report that the Pittsburgh & Western was reported as being in the market for 500 new cars. We are now informed by the Receiver of the road that it is a question whether wooden or steel cars will be constructed, and that the matter may be determined within a few days.

The 250 ventilated fruit cars of the Florida, Central & Peninsular, referred to last week, will be equipped with Westinghouse air brakes, Tower couplers and Garrett & Co.'s brasses. One hundred and twenty-five of the cars will have Chicago roofs and a like number of Ruberoid roofs made by the Standard Paint Co., of New York City. For the 250 fruit cars metal trucks are specified. Cloud trucks and Bettendorf body bolsters will be used on 25 of the cars, Mansfield trucks for 25 cars and Schoen trucks and body bolsters for the remaining 200 cars ordered.

The open cars of the North and West Chicago street railroads are being altered at the shops in Chicago and are now almost completed. Wire screens are being placed along the sides next the second track, and the side steps are also being removed, so that there will be no foothold, except on the safe side, from which alone the cars can be entered.

The Canadian Pacific is having 20 tourist cars built by the Crossen Car Mfg. Co., of Coburg, Ont., the order for which we noted some time ago. The outside finish will be cherry and the inside birch. The road is building at its Montreal shops 20 first-class coaches and 10 sleeping cars. The coaches will be finished outside in mahogany and inside in Prima Vera. The main compartment will be divided into three sections by means of arches thus destroying the monotonous corridor effect commonly found in cars in this country. The ten sleeping cars will be finished inside and outside in mahogany; each car will have two staterooms, a large smoking room and annex and a ladies' large dressing room, with annex. Although the cars will be 70 ft. 6 in. long over sills, only eight sections are provided, the object of the

company being that every compartment shall be roomy and comfortable. The interior decoration is in charge of a Parisian decorator. The sleepers, coaches and tourist cars will all be equipped with the Standard safety platform, wide end vestibules, wrought iron steel-tired truck wheels, Westinghouse air-brakes and signals, automatic couplers and steam heating.

BRIDGE BUILDING.

Beauford, Minn.—Bids are asked by the County Surveyors of Blue Earth County for building an iron bridge over Little Cobb River at Beauford.

Bridgeport, Conn.—The Common Council has asked the Board of Apportionment to appropriate \$25,000 for building a new bridge.

Buckley, Wash.—A bridge will probably be built here at a cost of \$6,000, to have a span of 180 ft. T. Ryan County Surveyor, Pierce County.

Canastota, N. Y.—A bill has been introduced in the Assembly at Albany, by Robert J. Fish, asking for an appropriation of \$18,000 to build a bridge at Peterboro street over the Erie Canal at Canastota.

Charleston, Miss.—A bill has been introduced in Congress by Mr. Catchings, extending the time when the bridge over the Tallahatchie River, in Tallahatchie County, must be completed to Nov. 1, 1898.

Cohoes, N. Y.—A company has been organized with a capital stock of \$40,000 to build a bridge over the Mohawk River at Dunsbach Ferry. The following are Directors: James S. Clute, John H. Murphy, William T. Ford and John Scanlon, of Cohoes, and Edwin W. Marvin, of Troy.

Columbus, Miss.—On the line of the Columbus, Fulton & Northern, now building, there will be three iron bridges of about 75 ft. each. The officers of the company are Newman Cayce, Columbus, Miss., President; J. W. Buchanan, Memphis, Tenn., Vice-President; J. T. Senter, Secretary and Treasurer.

Grand Rapids, Mich.—It is reported that an election will be held in April to vote on the question of issuing \$10,000 in bonds to be used in building a bridge at Plainfield, Kent County.

Monroe, La.—The city of Monroe, in conjunction with the Ouachita Parish, has been authorized by Congress to build a bridge across the Ouachita River. Work must be begun by Aug. 8, and they have three years in which to complete the work.

Montreal, Que.—L. K. Jones, Secretary Department of Railways and Canals, Ottawa, will receive tenders until the 31st inst., for the masonry, etc., in substructure of swing and stationary bridges, the erection of a swing and fixed bridge in St. Gabriel locks, at the intersection of Seigneurs street.

New York, N. Y.—A bill has been introduced in the Assembly at Albany authorizing New York City to bond itself in \$200,000 for the improvement of Moshulu Parkway between Bronx Park and Van Cortlandt Park. This includes a bridge over the New York & Harlem Railroad tracks.

Ottawa, Ont.—Mr. G. C. Dunn, Chief Engineer of the Ottawa & Gatineau Valley, and Pontiac & Pacific Junction railroads, states that work on the interprovincial bridge between this city and Hull, Que., will be commenced in the course of a few days, and that \$50,000 will be spent on the work by the middle of March.

Ozark, Ala.—The County Commissioners of Dale County have been authorized by Congress to build two bridges across the Choctawatchee River, one near Newton and one on the sight of the Hollies bridge.

Quebec, Ont.—The Ontario Legislature has concurred in the Government resolution which grants out of the consolidated revenue funds the sum of \$35,000 toward building an international railroad bridge across the St. Lawrence River at Cornwall, provided that aid will be granted also by the Canadian Parliament.

Sandy Hill, N. Y.—A bill has been introduced in the Assembly to appropriate \$6,000 for a street bridge over the Erie Canal at Main Street.

Shreveport, La.—The Shreveport Bridge & Terminal Co. has had a bill introduced in Congress by Mr. Ogden to authorize it to build a bridge across Red River at or near Shreveport.

Staples, Minn.—It is reported that a bridge will be built over Crow Wing River, north of Staples, Todd County.

Utica, N. Y.—The Superintendent of Public Works, George W. Aldridge, office in Albany, has advertised for proposals for building lift bridges over the Erie Canal at Whitesboro street and at Broad street, Utica.

A bill has been introduced in the Assembly by Mr. Coggeshall asking for an appropriation of \$18,000 for a bridge at Schuyler street.

York, Neb.—It is reported that a number of new bridges will be built in York County this year.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Buffalo & Susquehanna, annual, 5 per cent., payable Feb. 1.

Cincinnati, Hamilton & Dayton, quarterly, preferred, 1½ per cent., payable Feb. 8.

Illinois Central, semi-annual, 2½ per cent., payable March 1.

Mobile & Ohio, 1 per cent., payable Feb. 28.

Pittsburgh & Lake Erie, 5 per cent., payable Feb. 1.

Columbus (O.) Street Ry., quarterly, 1 per cent., payable Feb. 1.

Dry Dock, East Broadway & Battery (N. Y.), quarterly, 1½ per cent., payable Feb. 1.

St. Charles Street (New Orleans), quarterly, 1½ per cent., payable Jan. 24.

Stockholders' Meetings.

Missouri Pacific, election of directors, St. Louis, March 8.

St. Louis, Iron Mountain & Southern, election of directors, St. Louis, March 8.

Norfolk & Southern, election of directors, Norfolk, Va., March 8.

The Engineers' and Architects' Club of Louisville,

Ky., meets on the third Monday in each month, 16 Norton Building.

Engineers and Architects Club of Louisville.

The annual meeting of the Engineers and Architects Club of Louisville, Ky., was held at the Club Rooms, 16 and 18 Norton Building, Jan. 17. The following officers for the ensuing year were elected: President, Webster Gazley; Vice-President, Wm. B. Blake; secretary, Jas. K. Zollinger; Directors, Henry Vogt, J. P. Claybrook, J. C. Murphy, Marshall Morris, Granville W. Shaw, Chas. Hermany. The Club meets on the third Monday in each month.

Engineers' Club of St. Louis.

The 465th meeting was called to order Jan. 19, at 8 p. m., with President Bryan in the chair. Nineteen members and two visitors were present.

The paper of the evening, entitled "Experiments With a New Machine for Testing Materials by Impact," was then read by Mr. S. Bent Russell. The paper opened with a discussion of the subject of resilience. A description was given of the usual methods of testing materials by impact, and drawings of the new machine were exhibited. The method by which the machine had been calibrated and tested was given. Tables of tests on different materials, drawings, samples of broken specimens, and cutters used in forming test bars were exhibited.

National Association of Manufacturers.

The third annual convention of the National Association of Manufacturers of the United States was held in the assembly hall of Masonic Temple, Twenty-third street and Sixth avenue, New York City, Jan. 25, 26 and 27. The session opened with an address by Randolph Guggenheimer, President of the Municipal Council of the Borough of Manhattan. He was followed by the President of the Association, Theodore C. Search, of Philadelphia. On the afternoon of Jan. 25 a luncheon was given on board the American Liner St. Louis by the International Navigation Co. On the evening of the same day a smoker was held at the Waldorf-Astoria. The annual dinner was also given at the same hotel on the evening of Jan. 27.

Institute of Mining Engineers.

The seventy-fourth meeting of the Institute (being the twenty eighth annual meeting) will be held, at Atlantic City, N. J., beginning on Tuesday evening, Feb. 15, 1898. Hotel headquarters will be at Haddon Hall, and sessions will be held in the Casino, which will be opened specially for the use of the Institute. The number of members who have signified their intention of attending this meeting is large. A subscription banquet will probably be held at the St. Charles on Thursday evening, Feb. 17. It is expected that the meeting will close with a visit on Friday to *The Philadelphia Museum*, where a complimentary luncheon will be served, without return to Atlantic City. The following are a few of the papers thus far announced for this meeting:

Compressed Air Power Transmission at Kellogg, Idaho, by F. W. Bradley, Washington, Cal.

A New Form of Ingot-Mould for Casting Brass or Bronze Ingots, by Erwin S. Sperry, Bridgeport, Conn.

The Bildt Automatic Feed-Device for Gas-Producing, by C. W. Bildt, Worcester, Mass.

A New Departure in Breaker Building, by W. S. Ayres, Hazleton, Pa.

Mining Timber and the Forest Reserves, by Gifford Pinchot, Washington, D. C.

Western Society of Engineers.

In our issue of Jan. 14 was given a list of the officers elected at the last annual meeting of the Western Society of Engineers, to serve during the coming year. These officers at a recent meeting appointed the following standing committees:

Finance, A. V. Powell, J. F. Lewis and C. L. Strobel; Publication, J. J. Reynolds, T. T. Johnston and T. L. Condon; Library, G. P. Nichols, J. W. Alvord, F. P. Kellogg and E. E. Grant; Membership, Horace E. Horton, Ferd. Hall and C. W. Melcher; Quarters, Alfred Noble, Jas. F. Lewis, C. L. Strobel, C. W. Melcher and Geo. P. Nichols. The Committee on Professional Papers will be as follows: T. L. Condon, Chairman; for General Engineering, Thos. Appleton and Ira O. Baker; for Municipal Engineering, J. H. Spengler and J. A. Harman; for Mechanical Engineering, C. E. Billin and T. W. Snow; for Electrical Engineering, H. M. Brinckerhoff and D. C. Jackson; for Hydraulic Engineering, W. G. Price and L. M. Mann; for Architectural Engineering, Dankmar Adler.

It has been proposed to devote six of the 21 meetings during the coming year to topical discussions, one evening being given to each of the following or kindred subjects:

Steel and Iron; Manufacture, Properties, Special Requirements and Examples of failures in Service; Electric, Pneumatic and Mechanical Power Transmission in Manufacturing Establishments; Paying of Business and Residence Streets; Gaging of Streams; Fire-proofing of Buildings; Substitution of Metal for Wood in Car Construction.

A list of the subjects of the papers to be presented at the meetings during the next six months will soon be announced.

Lake Carriers' Association.

The annual meeting of the Lake Carriers' Association was held at Detroit Jan. 19 and 20; about 200 lake men present. The report of the Board of Managers showed the tonnage enrolled for the year just closed was 687,237 net registered tons, the largest of any year excepting 1896, when it was 722,863 tons. The report also shows the gradual dropping out of small vessels, their places being taken by those of larger tonnage. The report takes up at length the improvements to channels, extensions of water transportation from Lake Erie to the sea, and the progress of the organized movement of lake and ocean shipping interests toward the building up of an American merchant marine. The most important legislative work of the Association during the year was securing the lighting of lake channels and water ways by gas buoys, 40 of which have already been sent to the lake lighthouse districts and 20 were in actual use last season in addition to two Canadian gas buoys.

Last season Buffalo handled 250,000,000 bu. of grain, for which the shoveling charges were \$3.35 per 1,000 bu., which all agreed was too high. It was stated that if the expenses of carrying grain could be kept down to the minimum, traffic for export via the lakes could be held, which otherwise would be likely to go via the Gulf of Mexico. A special committee on the Buffalo grain shoveling contract was appointed and recommended that the contract be given to W. J. Connors, of Buffalo, at \$2.95 per 1,000 bu., and the Association voted to confirm the recommendation.

The Committee on "Minimum Rates on Coal and Ore" reported that these were not proper subjects for action by the Association, and suggested that the vessel owners meet individually to discuss carrying rates. The report was adopted, but no meeting was called as suggested. Capt. J. S. Dunham, President of the Dunham Towing

& Wrecking Co., of Chicago, was elected President of the Association for the ensuing year.

Western Railway Club.

In our last issue a brief account of the proceedings of the Western Railway Club meeting, Tuesday, Jan. 18, was given, and a more complete report promised.

In the absence of the President of the Club, Mr. F. A. Delano, the meeting was called to order by Mr. E. M. Herr, First Vice-President. A communication was read from the Engineers' Club of Chicago, inviting the members of the Western Railway Club to attend its meetings. On motion a committee was appointed consisting of Messrs. G. W. Rhodes, Peter H. Peck and C. A. Schroyer to consider what changes in the "Rules of Interchange" should be recommended, and the recommendations of the committee will be discussed and action taken at the March meeting of the Club.

It was announced that following up the subject of "Rails," at the next meeting, short papers will be presented on the different processes of making steel. The advantages arising from the use of nickel steel, steel treated by the Coffin process and cast steel will be included in the discussion.

As previously announced in this column, "Rails" was the principal topic considered at the last meeting, and to direct the discussion, Mr. F. A. Delano furnished in advance of the meeting the data obtained from certain rail tests made by the government engineers at the World's Fair, at his suggestion. These tests included not only laboratory tests to show the deflection of short sections of rails under different loadings, but also tests were made to show the deflection of rails in the track under the weight of different classes of locomotives. These latter tests were made in the Hawthorne Yard, on the Chicago, Burlington & Quincy. Mr. E. C. Potter, formerly connected with the Illinois Steel Company, also furnished considerable information in regard to the development and history of the rail section. The following questions were issued by the Secretary in advance of the meeting with a view to drawing out information:

"What is the most economical weight of rail for railroads with heavy traffic?"

"Does quality of rail improve, or become inferior, as the weight of rail increases?"

"Are railroads purchasing rails on intelligible specifications?"

"What form of test will give the most reliable information about rails?"

"What is the safe maximum rolling load for rails of different weights?"

A question asked in the meeting was what wheel loads can be safely used with rails weighing 100 lbs. per yard, and what is the relation between the weight of rail and the allowable loading for rails of different weights?

In the discussion only one of these questions was answered, namely, that the drop test for rails is the most reliable, and it would appear that the subject of rails is one in which very few of the members of the Western Railway Club are directly interested or are fitted to discuss with profit. Professor Goss suggested that in view of the lack of definite information in regard to track matters a track laboratory for carrying on experiments might be required before definite conclusions could be reached.

The topic, whether tracks in erecting shops should be longitudinal or transverse, was briefly discussed.

PERSONAL.

—Mr. Martin Shannon, heretofore Supervisor of the Waynesburg & Washington, died at Waynesburg, Pa., Jan. 11, at the age of 55.

—Mr. Frank E. Moore, heretofore Agent for the Cleveland, Cincinnati, Chicago & St. Louis, died at his home in Delaware, O., Jan. 14.

—Mr. William Brewster, a Director, Secretary and Treasurer of the Erie & Pittsburgh, died in his office at Erie, Pa., Jan. 21, at the age of 70.

—Mr. J. W. Donovan, heretofore Division Superintendent of the Cascade Division of the Great Northern, has resigned on account of ill health.

—Mr. W. E. Wicker, late Contracting Agent of the Chicago, Milwaukee & St. Paul at San Francisco, Cal., died recently in that city at the age of 40.

—Mr. L. F. Eddy, heretofore Contracting Agent of the Detroit & Lima Northern, with headquarters at Toledo, O., has resigned. His resignation took effect Jan. 1.

—Mr. W. W. Stockton, heretofore Car Accountant of the Indiana, Decatur & Western, with headquarters at Indianapolis, Ind., has resigned; resignation to take effect Feb. 1.

—Gen. James Longstreet has been appointed by President McKinley to be Commissioner of Railroads. The nomination was confirmed by the Senate Jan. 22, by a vote of 33 to 15.

—Mr. C. C. McNeill, General Superintendent of the Maricopa & Phoenix and Salt River Valley, with headquarters at Phoenix, Ariz., has resigned, resignation took effect Jan. 15.

—Mr. W. H. Smith, Manager of the Lackawanna line, with headquarters at Buffalo, N. Y., has resigned, his resignation taking effect Jan. 26. Mr. Smith resigns on account of ill health.

—Mr. John Laird, ship builder of Birkenhead, England, died Jan. 25 at Liverpool, at the age of 55. Mr. Laird was senior member of the firm of Laird Brothers, ship builders of England.

—Mr. Samuel J. Barclay, heretofore General Agent of the Chicago Great Western, with headquarters at Butte, Mont., has resigned, and it is reported that Mr. P. M. Seymour has been appointed as his successor.

—Mr. D. G. Charles, a Civil Engineer and newspaper man, died Jan. 19, at St. Luke's Hospital, New York City, at the age of 48. He was formerly connected with the Chattanooga Times, Chattanooga, Tenn.

—Mr. Edward D. Harlow, formerly Treasurer of the Boston, Concord & Montreal and the White Mountain, leased roads of the Boston & Maine, died at his residence in Salem, Mass., Jan. 7, at the age of 59.

—In our issue of last week reference was made to the death of Mr. Jacob Garabrant Neafe, President of the Neafe & Levy Ship & Engine Building Co., but his name was incorrectly spelled. It was recorded as Leafie, which was wrong.

—Mr. Charles R. DeFreest, formerly Secretary of the Board of Railroad Commissioners of New York, and recently appointed to have charge of the inspection of railroad crossings, has resigned this office, his resignation to take effect Feb. 1.

—Mr. George C. Buell, a Director of the New York Central & Hudson River, died at his home in Rochester.

N. Y., Jan. 24, at the age of 75. Mr. Buell was the senior member of the wholesale grocery firm of George C. Buell & Co., of Rochester.

—Mr. W. L. Elsefer, Civil Engineer, died recently in New York, at the age of 45. He was at one time connected with the New York Central & Hudson River, and in 1897 prepared a report on the Pacific railroads for the United States Senate Commission.

—Mr. E. S. Blair, heretofore General Agent of the Passenger Department of the Rio Grande Western, at Butte, Mont., has resigned, to accept the position of General Agent of the Great Northern at San Francisco, Cal. The resignation takes effect Feb. 1.

—Mr. John C. Stuart, heretofore Superintendent of the Galena Division of the Chicago & Northwestern, with headquarters at Chicago, Ill., has resigned to go to the Chicago, St. Paul, Minneapolis & Omaha as General Superintendent. His resignation took effect Jan. 1.

—Mr. George McDill, Chief Clerk to Horace G. Burt, President of the Union Pacific, has resigned his position in order to devote more time in traveling throughout the United States, encouraging and promoting the work of the railroad branches of the Young Men's Christian Association.

—Mr. Thomas H. Morris, who for six years has been the Manager of the Mahoning & Shenango Valley Car Service Association, has resigned, and the Directors have chosen Mr. P. A. Lynn, formerly with the Wabash road, to fill the vacancy. The office of the Association is at Youngstown, O.

—Mr. Edmund Taylor died at Raton, N. Mex., Jan. 17, at the age of 80. Mr. Taylor began his railroading on the Baltimore & Ohio in 1855, and had filled many positions in the operating department on that road. He also served with the Wabash, Iron Mountain, and Missouri Pacific as Master Mechanic.

—Mr. John Denner, heretofore Traveling Freight and Passenger Agent of the Union Pacific, Denver & Gulf, with headquarters at New Orleans, La., has resigned; the resignation taking effect Feb. 1. He will, in the future, be the General Southern Representative of the Gulf Bag Co., of New Orleans.

—In our issue of last week we stated that Mr. W. Davis, General Freight Agent of the Buffalo, Rochester & Pittsburgh, with headquarters at Rochester, N. Y., had resigned. Mr. Davis informs us that he has not tendered his resignation, nor does he intend to, and does not know how the report originated.

—Major John B. Stannard, a civil engineer, died at his home in Berryville, Va., Jan. 25, at the age of 77. He was a Division Engineer in the construction of the New York Central & Hudson River. He was also Major of Engineers and Superintendent of the building of the fortifications around Richmond during the Civil War.

—Mr. W. E. Hodges, heretofore General Purchasing Agent of the Gulf, Colorado & Santa Fe., with headquarters at Chicago, Ill., has resigned. The resignation took effect Jan. 11. Mr. Hodges is also General Purchasing Agent of the Atchison, Topeka & Santa Fe, with headquarters at Chicago, Ill. He will continue as such.

—Mr. William Ayers Galbraith, at one time attorney for the Sunbury & Erie, now a part of the Philadelphia & Erie, died at his home in Erie, Pa., Jan. 3, at the age of 75. In 1857 he was one of the contractors for the building of the Hoosac Tunnel. He was also largely interested in railroads in Chicago, and President of the Erie Dime Savings and Loan Company.

—Mr. W. Sanger Pullman, son of the late George M. Pullman, has been appointed to an office in the District Superintendent's office of the Pullman Palace Car Co., Chicago. At a meeting of the Directors of the Pullman Company, held in Chicago, Jan. 20, it was agreed that no successor to the late President Pullman would be chosen until the next annual meeting in October.

—Mr. James A. Millholland, Superintendent and General Manager of the George Creek & Cumberland Railroad and the Consolidated Coal Company, at Cumberland, Md., is soon to be married in New York to Miss H. Woodward Blunt of that city, but a native and former resident of Montgomery County, Md. Mr. Millholland is a native of Reading, and a son of the late James A. Millholland, who, for many years, was the Chief Mechanical Engineer of the Reading road.

—Mr. James Lillis, capitalist general contractor and railroad builder, died at his home in Kansas City, Mo., Jan. 17, at the age of 61. Mr. Lillis was, at different times, a contractor on the Burlington & Missouri River, Kansas City, Memphis & Mobile (now the Kansas City, Osceola & Southern), Northern Pacific, Lexington & Southern (now the Missouri Pacific), Chicago & Alton and the Atchison, Topeka & Santa Fe railroads and the Kansas City (Mo.) Elevated Steam Road. The tunnel of the elevated road through the west bluff of Kansas City, Mo., was cut by him.

—Col. J. T. M. Buffalo, heretofore Freight Agent of the Virginia, Tennessee & Georgia Air Line (Norfolk & Western), with office in New York, died at his home in New York City, Jan. 18. Colonel Buffalo was born in Raleigh, N. C., in 1822, and served during the Civil War on the staff of the General Chalmers of the Confederate Army. He came to New York in 1866 as Passenger Agent for the Memphis & Charleston, and a year or two later was appointed Agent for the Tennessee & Georgia Air Line, which position he has occupied ever since. No successor will be appointed.

—Mr. Eugene Melland, Treasurer of the Southern Trust Co., New York, died at his home in New York City, on Jan. 20, after an illness from the middle of December last. An operation was performed and he seemed to be recovering, but a relapse followed, owing to his exhausted vitality. Mr. Melland was born in New York City in 1834. At the age of 14 his family moved to Milwaukee, where he became a teller in George Smith's Bank. He afterward went to Eau Claire, Wis., where he was engaged in the banking business with Clark & Ingraham. In 1876 he returned to New York and associated himself with Prof. E. L. Youmans, Editor of the Popular Science Monthly, and also in the preparation of Appleton's Popular Science Encyclopedia. In 1881 he was elected Secretary of the Richmond & Allegheny.

—Mr. Oliver Blackburn Shallenberger, heretofore Consulting Electrician for the Westinghouse Electric Company, died at Colorado Springs, Col., Jan. 23. He was the first to demonstrate in this country, with the aid of George Westinghouse, the efficiency and safety of the alternating current. His experiments precipitated the long scientific dispute which resulted in the alternating current being adopted everywhere. Mr.

Shallenberger was born at Rochester, Beaver County, Pa., in 1860. He was graduated from the Naval Academy at Annapolis, but in 1884 he resigned from the navy and entered upon electrical work at Pittsburgh. He invented many things in the course of his electrical career of 14 years. Many of the efficient devices for central lighting stations were originated by him. In power transmission work he rendered aid of practical value. His electric meter is known the world over. He had been Consulting Electrician of the Westinghouse Company since 1891.

ELECTIONS AND APPOINTMENTS.

Allegheny & Western.—The officers of this company, referred to in another column, are as follows: W. W. Ames, Ridgeway, Pa., President; Arthur G. Yates, Rochester, N. Y.; Adrian Iselin, Jr., J. H. Hocart, Oscar Grisch, Columbus, O.; D. Iselin, Jos. Lee, New York City; C. H. McCauley, J. M. Grosch, C. H. McCauley, Jr., John G. Whitmal, J. N. Troxell, W. H. Holaday, Ridgeway, Pa.

Atchison, Topeka & Santa Fe.—E. W. Grant has been appointed Resident Engineer of the New Mexico & Rio Grande divisions, with headquarters at Las Vegas, N. Mex. F. H. Mudge has been appointed Resident Engineer of the Western Division, and also of that portion of the Middle Division west of Hutchinson, Kan., with headquarters at Pueblo, Col. J. M. Meade has been appointed Resident Engineer of the Eastern Division, and that portion of the Middle Division east of Hutchinson, Kan., and including M. & M. and Little River branches and the lines from Strong City northwest, with headquarters at Topeka, Kan., not Division Engineer at Pueblo as reported in our issue of Jan. 14. W. H. Earl has been appointed as Resident Engineer of the Oklahoma Division, with headquarters at Newton, Kan. M. N. Wells has been appointed as Resident Engineer of the Southern Kansas Division, with headquarters at Chanute, Kan. C. A. Morse remains as heretofore Resident Engineer of the Chicago Division, with headquarters at Fort Madison, Ia. These changes took effect Jan. 15.

Baltimore & Ohio Southwestern.—T. Seely, heretofore City Passenger Agent at Cincinnati, has been appointed Traveling Passenger Agent, with headquarters at the same place.

Baltimore, Chesapeake & Atlantic.—A. J. Benjamin heretofore Freight and Passenger Agent, has been appointed Superintendent of the Railway Division, with headquarters at Salisbury, Md. He is to report to the General Manager, Turnbull Murdock, heretofore Passenger Agent, has been appointed General Passenger Agent, with headquarters at Baltimore, Md. J. Sayer Wilson, Jr., son of President Wilson, and heretofore Freight Agent, has been appointed General Freight Agent, succeeding Willard Thompson, with headquarters at Baltimore. W. J. Morris has been appointed Division Freight and Passenger Agent, with office Salisbury, and A. Wooten has been appointed Agent at Salisbury, Md.

Boston Elevated.—C. S. Sargeant has been appointed Second Vice-President. Mr. Sargeant, a native of Northampton, Mass., went to Boston, and entered the service of the Eastern in 1876, and was shortly afterward made its General Auditor, and continued as such until that road was leased to the Boston & Maine. In 1887 he went to the West End (Boston), which was being consolidated with several other street railways, and has been Auditor and Second Vice-President and General Manager respectively of that company.

California Eastern.—At the annual meeting of this company, held at Denver, Colo., D. S. Scofield, of San Francisco, Cal., was elected First Vice-President; W. N. Byers, of Denver, Colo., was elected Second Vice-President and Treasurer, and Frank S. Woodbury, of Denver, Secretary.

Central of Georgia.—D. Morrison Rea, Assistant Commercial Agent of the Savannah line of steamers on the Central of Georgia, has been appointed Commercial Agent of these companies, with headquarters at Mobile, Ala. The appointment takes effect Feb. 1.

Chicago, Bluffton & Cincinnati.—At the annual meeting, held at Portland, Ind., Jan. 14, directors were elected as follows: Frederick W. Short, 184 Dearborn street, Chicago, Ill.; Edmund G. Short, Neziab W. Bliss, William R. Thrasher, William S. Walker, Arthur L. Sharpe and S. Douglass Graham.

Chicago & Northwestern.—W. E. Morse, who has been Assistant Superintendent of the Madison Division, with headquarters at Baraboo, Wis., has been appointed Superintendent of the Galena Division, succeeding J. C. Stuart, resigned. The appointment took effect Jan. 1.

Chicago, Peoria & St. Louis.—The office of General Manager, Henry W. Gays, has been removed from Springfield, Ill., to St. Louis, Mo. The change was made Jan. 1.

Chicago, Rock Island & Pacific.—H. S. Ray has been appointed Traveling Passenger Agent, with headquarters at Pittsburgh, Pa., succeeding E. E. MacLeod, resigned.

Chicago, St. Paul, Minneapolis & Omaha.—John C. Stuart, heretofore Superintendent of the Galena Division of the Chicago & Northwestern, with headquarters at Chicago, Ill., has been appointed General Superintendent of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at St. Paul, Minn.

Cincinnati, Hamilton & Dayton.—A. D. McCullom has been appointed Master Mechanic of the Cincinnati, Hamilton & Indianapolis Division with headquarters at Hamilton, O.

Columbus, Fullon & Northern.—The officers of this company, referred to in another column, are: President, Newman Cayce, Columbus, Miss.; Vice-President, J. W. Buchanan, Memphis, Tenn.; Secretary and Treasurer, J. T. Senter, Columbus, Miss.

Delaware, Susquehanna & Schuylkill.—At the annual meeting of the stockholders, held at Drifton, Pa., Jan. 10, Irving A. Stearns was elected a Director, succeeding Alfred White.

Detroit, Toledo & Milwaukee.—R. W. Farnsworth has been appointed Contracting Agent, with headquarters at Toledo, O., succeeding L. F. Eddy, resigned. The appointment took effect Jan. 1. The appointment is also effective on the Detroit & Lima Northern.

Fonda, Johnstown & Gloversville.—At the annual meeting, held at Gloversville, N. Y., Jan. 20, Erastus Darling was elected a Director, J. Ledlie Hess, heretofore Treasurer, was elected President, George M. Place, heretofore Secretary, was elected Secretary and

Treasurer. The headquarters of both are in Gloversville, N. Y.

Grand Trunk.—Assistant Superintendent A. R. McIntyre, with headquarters at Battle Creek, Mich., will hereafter include in his territory districts 28 and 29 as well as 26 and 27. He will have jurisdiction over all the lines operated over the Grand Trunk in Michigan. The appointment takes effect Feb. 1.

H. R. Charlton has been appointed Advertising Agent, with headquarters at Montreal, Que., succeeding A. H. Armstrong, who resigned several months ago. The appointments took effect Jan. 1. Mr. Charlton was formerly in charge of the Advertising Department of the Canadian Pacific.

Great Northern.—E. S. Blair, heretofore General Passenger Agent of the Rio Grande Western, at Butte, Mont., has been appointed to a similar position on the Great Northern, with headquarters at San Francisco. The appointment takes effect Feb. 1.

P. F. Connelly, heretofore Roadmaster of the Fergus Falls Division, has been appointed Superintendent of the Kalispell Division, succeeding J. P. Rodgers. His headquarters will be at Kalispell, Mont.

P. Nolan, heretofore Roadmaster of the Montana Central, at Great Falls, Mont., has been appointed Division Superintendent of the Cascade Division of the Great Northern, succeeding J. W. Donovan, who recently resigned. The appointment took effect Jan. 15.

Gulf, Colorado & Santa Fe.—T. O. Wood, heretofore General Storekeeper, has been appointed Purchasing Agent, with headquarters at Chicago, Ill., succeeding W. E. Hodges, resigned. The appointment took effect Jan. 11.

Houston, East & West Texas.—W. H. Taylor has been appointed Commercial Agent, with headquarters at Kansas City, Mo. The appointment took effect Jan. 15.

Indiana, Decatur & Western.—G. H. Waldo has been appointed Superintendent of Car Service, with headquarters at Cincinnati, O. The appointment takes effect Feb. 1. Mr. Waldo is also Superintendent of Car Service of the Cincinnati, Hamilton & Dayton.

Intercolonial.—The jurisdiction of J. J. Wallace, General Freight Agent, and that of Mr. John M. Lyons, General Passenger Agent, has been extended over the Prince Edward Island Railway. Their headquarters are still to be at Moncton, N. B. William Robinson, Division Freight Agent, with headquarters at St. John's, N. B., is to have charge of freight traffic from St. John to Moncton, inclusive, and north of Moncton to and including Eel River, N. B.; also the Point du Chene Branch and the Prince Edward Island Railway. James B. Lambkin has been appointed District Passenger Agent, with headquarters at Montreal, in charge of the territory west of and including Dalhousie, N. B. H. A. Price has been appointed District Passenger Agent, with headquarters at Halifax, N. S.

Iowa Central.—F. W. Boltz has been appointed General Agent for the territory covering the Middle States, with headquarters at Indianapolis, Ind. Mr. Boltz has been Commercial Agent for many years of the Chicago, Milwaukee & St. Paul, and later Division Freight and Passenger Agent of that road at Sioux City, Ia., from which position he retired Jan. 1.

Kansas City, Pittsburgh & Gulf.—John O. Sargent, General Freight Agent, has had his jurisdiction extended over the Kansas City & Northern Connecting, Omaha, Kansas City & Eastern and Omaha & St. Louis, which are parts of the Kansas City, Pittsburgh & Gulf. R. W. Blakeslee, formerly General Freight Agent of the Omaha & St. Louis and Ohio, Kansas City & Eastern, has been appointed Assistant General Freight Agent of all the lines forming parts of the Kansas City, Pittsburgh & Gulf. His headquarters are to be at Quincy, Ill. G. M. Entrikin has been appointed Assistant General Freight Agent, with headquarters at Omaha, Neb.

Las Vegas, Mora & Taos.—The officers in this company, referred to in another column, are President, F. A. Manzanares; Secretary and General Agent, Robert M. L. Ross; Treasurer, Edward B. Wheeler, all of East Las Vegas, N. Mex. Additional Directors: N. M. Dunn, Ro-ciada, N. Mex., and N. M. Wheeler, East Milton, Mass.

Lehigh Valley.—Asa L. Foster, heretofore Through Freight Agent, with headquarters at Philadelphia, Pa., has been appointed General Freight Agent, succeeding J. H. Heckerman, transferred. C. A. Blood, heretofore Division Freight Agent, has been appointed Assistant General Freight Agent at Philadelphia. Allan Hunter has been appointed Through Freight Agent at Philadelphia, succeeding Mr. Foster. John Heckerman, heretofore General Freight Agent, has been transferred to South Bethlehem, Pa., as Division Freight Agent. It is reported that the Freight and Passenger Departments will shortly be removed from Philadelphia to New York.

Lewisburg & Buffalo Valley.—At the annual meeting, held at Sunbury, Jan. 17, the following new Directors were elected: Col. W. C. McConnell, John Lisenring, Congressman G. G. Culp was elected Vice-President. For the incorporation of this company see this column for May 14, 1897.

Little River Valley.—The directors and officers of this company, referred to in another column, are as follows: President, D. C. Richardson; Vice-President, L. A. Byrne; Secretary, F. M. Butts. Directors: The three above-named, J. M. Lind, and H. H. Lunnely. The principal office is at Horatio, Ark.

Louisville, Henderson & St. Louis.—George Greer has been appointed Traveling Engineer, with headquarters at Cloverport, Ky.

—Walter R. Hill has been appointed Traveling Freight Agent, with headquarters at Louisville, Ky. Appointment took effect Jan. 1.

Maricopa & Phoenix & Salt River Valley.—B. F. Porter has been appointed Acting Superintendent, succeeding General Superintendent C. C. McNeil, resigned. His headquarters are at Phoenix, Ariz. Appointment took effect Jan. 15.

Merchants' & Miners' Transportation Co.—A circular just issued announces that the following appointments took effect Dec. 1, 1897, on the Central of Georgia, the Plant System and the Merchants' & Miners' Transportation Co.: Carroll H. Smith, Agent at Philadelphia, Pa.; F. L. Mortimer, Agent at Baltimore, Md.; J. B. Andrews, Agent at Baltimore; L. T. Fowler, Traveling Agent at Pittsburgh, Pa.

Middletown & Hummelstown.—At the annual election of this company, which is a part of the Reading, held at Philadelphia Jan. 23, J. D. Landis was elected a director, succeeding C. E. Metzler.

Minnesota, St. Paul & Sault Ste. Marie.—Alexander Amos, heretofore General Foreman of Bridges, has been appointed to the new office of Superintendent of Bridges and Buildings. His headquarters are at Shoreham, Minn. Appointment took effect Dec. 25.

Mohusville & Adamstown.—At the annual meeting of stockholders of this company, held at Reading, Pa., Jan. 24, F. W. Flood, August W. Hoff, O. S. Geiger and G. Fred Mertz were elected as Directors.

New York Central & Hudson River.—Samuel Emerson, heretofore Chief Clerk to General Roadmaster W. T. Otis of New York City, has been made Roadmaster of the Mohawk & Malone, which is a part of the New York Central & Hudson River. His headquarters are to be at Tupper's Lake, N. Y.

New York, Ontario & Western.—At the regular monthly meeting of the Directors, held at the company's office in New York City, Jan. 26, Chauncey M. Depew, President of the New York Central & Hudson River, was made a Director, to fill the vacancy on the Board, caused by the death of W. H. Paulding, of Peekskill, N. Y. (See these columns for Jan. 7.)

North Shore Dispatch.—The officers that have been appointed for this new Fast Freight Line, noted in the Traffic Department in the issue of last week, are as follows: General Manager, W. G. Mann; General Agent, Stuart A. Allen; General Western Agent, Harry Lee Wyatt. The headquarters are at Detroit, Mich. This company is to begin operations Feb. 1.

Omaha, Kansas City & Eastern.—The office of Commercial Agent at Quincy, Ill., has been abolished, and the duties of that office will hereafter be performed by Assistant General Freight Agent Blakeslee.

Ontario, Carbondale & Scranton.—At the annual meeting of the stockholders of this company, which is leased to the New York, Ontario & Western, held at Scranton, Pa., Jan. 20, Albert S. Roe was elected a director, to succeed C. D. Simpson.

Philadelphia & Reading.—S. W. Simon, formerly with the Boston & Maine, has been appointed Foreman of Engineers of the Shamokin Division, with headquarters at Tamaqua, Pa. The appointment took effect Jan. 1.

Pittsburgh & Lake Erie.—E. E. Book has been appointed to the newly created position of Traveling Foreman of Locomotives.

St. Louis, Vandalia & Terre Haute.—At the annual election of this company, held at Greenville, Ill., Jan. 11, the following new Directors were elected: James Woods, of Pittsburgh, and John P. Green, of Philadelphia. At a meeting of the Directors held later, the following officers were elected: James McCrea, President, succeeding John E. Davidson; Joseph Woods, Vice-President; C. D. Hoyle, Assistant Secretary, with headquarters at Pittsburgh, Pa.

San Francisco & North Pacific.—At the annual election of officers and directors of this company, held at San Francisco, Cal., Jan. 18, A. H. Payson was elected a Director, succeeding Antoine Barel. Andrew Markham was elected Vice-President, succeeding Phillip Libenthal, and Jess W. Libenthal was elected General Counselor, with headquarters at San Francisco, Cal.

Santa Rita.—The Directors of this company, the newly incorporated branch of the Atchison, Topeka & Santa Fe, are as follows: Aldace F. Walker, New York; Edward P. Ripley, Chicago; Henry L. Waldo, E. Las Vegas, N. Mex.; R. E. Twitchell, Las Vegas, N. Mex.; Rufus J. Palen, Robert C. Gortner, Santa Fe, N. Mex. The officers are: Chairman, Aldace F. Walker, New York, N. Y.; President, Edward P. Ripley; Third Vice-President, Paul Morton, Chicago; Secretary and Treasurer, E. Wilder, Topeka.

Spring Garden Connecting.—The officers of this company, referred to in another column, are William O. Kirkland, Beaver Co., President; Frank Feikel, Pittsburgh, and James Swindell, Allegheny City, Pa., Directors.

Terra Haute & Peoria.—At the annual meeting of the stockholders of this company, which is a leased line of the Terre Haute & Indianapolis, held at Decatur, Ill., Jan. 19, James T. Brooks was elected Vice-President, succeeding J. J. Parrish, and W. C. Phelps, Assistant Secretary.

Virginia, Tennessee & Georgia Air Line.—The office of Freight Agent, with headquarters in New York, formerly occupied by Col. J. T. M. Buffalo, whose death is referred to in another column, has been abolished.

Waco & Northwestern.—Dr. A. M. Curtis has been appointed Chief Surgeon, succeeding Dr. W. C. Jones, who recently resigned.

Wheeling & Lake Erie.—E. Z. Hermensader of Massillon, O., has been appointed Assistant Master Mechanic of the shops at Norwalk, O., succeeding Bernard McGinn, who has been assigned to other duties.

Wisconsin & Michigan.—At the annual meeting of the Directors, held at Chicago, Ill., Jan. 18, the following officers were elected: S. M. Fischer, President and Treasurer; J. J. Coleman, Vice-President, O. A. Koss, Secretary. Many reports have stated that General Manager J. M. Faithorn had resigned his position, which is incorrect. As no action was taken to elect or appoint a General Manager, the office was thereby abolished.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Alabama & Tombigbee.—It is stated that grading is in progress between Fulton, Ala., and Net leboro, on this line projected to run from Lower Peach Tree, Ala., east 37 miles to Coffeeville. Geo. R. Hannon, Fulton, Ala., is General Manager. (See this column for Dec. 17.)

Allegheny & Western.—An agreement to merge the Jefferson & Allegheny and the Allegheny & Western into the Allegheny & Western has been filed at the State Department at Harrisburg, Pa. The capital stock of the consolidated company will be \$2,500,000. The Jefferson & Allegheny was to run from Clayville, on the Buffalo, Rochester & Pittsburgh, to Sharpburg, Pa., a distance of 90 miles. The Allegheny & Western from Mosgrove, on the Jefferson & Allegheny, to a connection with the Pittsburgh & Western at New Castle, Pa., a distance of about 63 miles. The officers of the consolidated company are given in another column.

Atchison, Topeka & Santa Fe.—The Santa Rita Company, incorporated in New Mexico, Dec. 24, is to form a part of the Atchison, Topeka & Santa Fe. The line is to be an extension of that road, and is to extend from San Jose, N. Mex., near Silver City, N. Dak., up the north side of the Santa Rita Creek to Santa Rita, Grant County, about four miles. As yet no work has been done, and the company does not know when it will be undertaken, but the road will probably be built by the company's own forces. The directors and officers are given in another column. (See this column for Jan. 7 and 21.)

Boyer City & Southeastern.—It is reported that right of way has been obtained for this line from Boyer City, Mich., to East Jordan, seven miles, and that building will begin at an early date. W. H. White, of Boyer City, is President and General Manager.

Carolina & Northwestern.—It is reported that J. R. Irvine & Co., of Morgantown, N. C., have been awarded the contract for grading the 10-mile gap on this road between Newton and Hickory, N. C. The trains on this branch of the road now run over the track of the Western North Carolina Division of the Southern. This road is successor to the Chester & Lenoir, and was reorganized about a year ago. G. W. F. Harper, of Lenoir, N. C., is President. (See this column for Aug. 6.)

Centralia & Chester.—Judge Allen, of the United States Court in Springfield, Ill., has issued an order authorizing C. M. Forman, Receiver, to re-locate the main line of this road near the city of Nashville, Ill., so as to place the depot near the business center of the city.

Chicago, Bluffton & Cincinnati.—At the annual meeting of this company held at Portland, Ind., Jan. 14, it was decided to begin construction within 90 days and to bond the road at \$20,000 per mile. This company was organized about a year ago to take over the property of the Cincinnati, Union City & Chicago. The Directors are given in another column.

The road is projected to run from Bluffton, Ind., via Portland, Camden and Union City to Huntington. Grading has been completed from Bluffton to Camden, 18 miles, and partially completed from Camden to Portland, 10 miles. There is an old grade from Portland to Union City, 21 miles, and surveys have been made from Union City to Huntington, 65 miles.

Chihuahua & Pacific.—It is officially stated that preliminary surveys have been completed and the company is now engaged in making final surveys for this Mexican road, which is projected to extend from Chihuahua west 200 km. (124 miles) by way of Santa Isabel and Cusihiuriachic to Guerrero, Mex., in the mineral districts of the Sierra Madre Mountains. It is expected that work will begin in a few months. Edward S. Safford, of Chihuahua, Mex., is Chief Engineer. (See this column for Jan. 14.)

Columbus, Fulton & Northern.—It is stated that this company, whose incorporation was noted in this column Dec. 31, proposes to build a line from Columbus, Miss., north about 130 miles through Pittsburgh Landing to Lexington, Tenn., with a branch from the main line near Savannah, Ga., crossing the Tennessee River to Nashville, Tenn. The grades will be small and no heavy work of any sort will be required. There will be three iron bridges of about 75 ft. each. No contracts for a line of bridges have yet been offered. The officers are given in another column.

Columbus Northwestern.—It is reported that track-laying has been completed from Santa Fe, O., to St. Johns on this road, from St. Johns, O., to Bellefontaine. J. T. Adams, of Bellefontaine, is General Manager. (See this column for Jan. 7.)

Duluth, Mississippi River & Northern.—It is officially stated that surveys have been made for an extension of this line from the Mesaba Range to Duluth, Minn., but the company does not expect to build in the near future.

Gila Valley, Globe & Northern.—A letter from this company states that grading has not yet been begun on this road from Beronimo, Ariz., northwest 60 miles to Globe. It is expected that work will begin in about 30 days. William Garland, 313 Stimpson Block, Los Angeles, Cal., is President. (See this column for Dec. 10.)

Guadalupe Valley.—It is reported that surveys are in progress for this road, which is projected to run from Galveston, Tex., west about 350 miles, to Brownsville, with a branch from Victoria to Pass Cabalo, and that grading will begin by Feb. 1. Contracts are to be let by the Guadalupe Valley Construction Company, of Victoria, Tex. Uriah Lott, of Victoria, Tex., is President and General Manager. (See this column for Dec. 31.)

Hutchinson & Southern.—It is reported that John Alexander, of Wichita, Kan., has obtained a contract for grading, and Charles Sawyer of Wichita, the contract for bridges on the proposed extension of this road from Medford, Okla., east 25 miles to Blackwell. Grading is about completed, and all the material has been purchased to build the line. E. E. Walker, of Hutchinson, Kan., is Vice-President and General Manager. (See this column for Oct. 15.)

Jaeger & Southern.—This company, which was incorporated in West Virginia, Jan. 22, proposes to build and operate a road from Jaeger, on the line of the Norfolk & Western, in McDowell County, W. Va., to the mouth of Jacob's Fork, a tributary of Dry Fork of Sandy River, a distance of about 35 miles. The capital stock of the company is \$25,000. Among the incorporators are W. M. Ritter, R. E. Pendleton, of McDowell County, W. Va., and James F. Brown, of Charleston, W. Va.

Las Vegas, Mora & Taos.—It is officially stated that locating surveys will be made in about one month. The company was incorporated in New Mexico, Jan. 5, with a capital stock of \$1,000,000 to build a line from Las Vegas, N. Mex., northwest through Mora to Taos, 85 miles. The route will be easy except about 12 miles of heavy mountain work, where the maximum grade will be 3 per cent. Contracts are now being made for right of way and for lands for station grounds and for town sites. The line will be standard gauge, using electricity generated by water power for mail, passenger and express service, and steam locomotives for hauling freight trains. It is proposed to furnish power for electric lighting and street car service on all points along the route. (See this column for Jan. 11.) The officers are given in another column.

Little River Valley.—It is officially stated that all the contracts have been let and most of the grading done on this line from Neal Springs, Ark., a point on the Texarkana & Fort Smith, west 18 miles toward the Arkansas State Line. This line is to be used principally for logging purposes. The company was incorporated in Arkansas, Dec. 3, with a capital stock of \$500,000. (See

this column for Dec. 10.) The officers are given in another column.

Luckiamute Valley & Western.—It is officially stated that building has commenced from Fall City, Or., to Salem, 23 miles. J. S. Talbot, of Dallas, Or., is President. (See this column for Jan. 14.)

Massachusetts Central.—A hearing was given by the Metropolitan Water Board in Boston, Mass., Jan. 24, on the relocation of the Massachusetts Central road, operated by the Boston & Maine, at the point where its present location will be submerged when the Wachusett reservoir on the Nashua river is filled. This section is between the West Berlin and Oakdale stations, about eight miles, including the present Boylston and West Boylston stations. Many residents of Clinton, who are anxious to have the relocated road pass through this town, were present, their idea being that it should join the Worcester, Nashua & Portland Division of the Boston & Maine at the Clinton station. There were also people from Boylston and West Boylston present to urge that the road run along the south shore of the reservoir and join its present location just beyond the Oakdale station. The Worcester Board of Trade urged the southern route, so as to get a line from Worcester to Boston shorter than the Boston & Albany. It is understood that the Boston & Maine favors the Clinton route rather than the southern. No final surveys have as yet been made.

McCloud River.—It is stated that this road from Upton, Cal., a point on the Southern Pacific, southeast 21.8 miles to McCloud, was completed during the year, but will not be operated until March. The extension was proposed from McCloud east 40 miles to Alturas, of which 20 miles may be built this year.

Mescagee Coal & Railway Co.—A bill recently introduced in the United States Senate by Senator Baker, authorizing this company to construct and operate a railroad through the Indian Territory and Oklahoma was passed Jan. 21. The proposed road is to begin near Fort Gibson, in the Cherokee reservation, I. T., and run through the Cherokee and Creek reservations and Oklahoma Territory to Vernon, Tex. The bill states that passenger rates shall not exceed three cents per mile. Congress reserves the right to regulate charges for freight and passengers and of messages on telegraph and telephone wires until a State Government shall exist in the territories. So long as the territories are owned and occupied by the Indians the company must pay to the Secretary of Interior for the use of the tribes, \$15 a year for each mile of railroad it shall construct. (See this column for Jan. 7.)

Miami River & Belt.—It is reported that surveys have been begun on this Belt Line from Minister, O., through Sidney to Lake View 40 miles. (See this column for Jan. 14.) H. T. Mathers, of Sidney, O., is President.

Mississippi River, Hamburg & Western.—It is stated that surveys have been completed for this line from Hamburg, Ark., east 46 miles, to the Mississippi River. J. N. Parker, of Hamburg, is President. (See this column for Dec. 31.)

National Tehuantepec.—It is reported that Sir Sweetman Pearson & Son have obtained a large lease of this road from the Mexican Government to run for 50 years. They assume control April 1. The condition of the lease is that the lessees should build the two harbors at Salina Cruz, the southern terminal of the road, and at Coatzacoalcas, the northern terminal, and to put into complete running order this road, which runs between these points 192.4 miles. The Mexican government guarantees six per cent. interest on such investments as is made on the road. In accordance with the lease, the Pearsons were obliged to satisfy a mortgage for \$175,000 held by the Seglins. It is estimated that the harbor work at Salina Cruz will cost from eight to ten million dollars, and at Coatzacoalcas from one-half million to two million dollars. This road was completed in 1894 by the Mexican government. The original concession was granted some years ago to Edward McIndo, of London, who failed to carry out his contract, and the concession was rescinded. The new contract was made in 1892 by Messrs. Stanhope and J. Hansome, of the City of Mexico, and E. L. Corthell, of Chicago, Ill., under which contract the work was completed. The highest elevation is at the crossing of the Sierra De Niza Conejo range, 924 ft. above the sea level. The maximum grade of the line is two per cent., and the curvature 200 meters (656 ft.) radius. There are bridges across five large rivers and one tunnel 300 ft. in length. (For a full description of this road with map see the columns of the *Railroad Gazette* for Dec. 7, 1894.)

New Roads.—The Common Council of San Diego, Cal., has granted a right of way, 100 ft. wide, through the city limits for a railroad to be built to the Colorado River. Several weeks ago a committee was appointed by the Chamber of Commerce, consisting of Matthew Sherman, U. S. Grant, Jr., M. A. Luce, William M. King and C. L. Josselyn, to secure railroad franchise, terminal facilities, etc., preparatory to negotiation with the railroad builders for such a line. A. E. Nutt, of San Diego, Cal., is Secretary of this committee.

The Rumbarger Lumber Company, of Dobbin, Grant County, W. Va., is building a 20-mile railroad from its plant in Dobbin to the timber lands in the interior of the county.

Norfolk, Virginia Beach & Southern.—It is reported that the extension of this road from Kempsville, near Norfolk, southeast 22 miles to Currituck Sound, has been practically completed, and that the road will be open for traffic about March 15. Alfred Skitt, of 3 Beaver street, New York City, is President. (See this column for Nov. 19.)

Pittsburgh, Chautauqua & Lake Erie.—It is reported that a contract has been let for that portion of this line from Mayville, N. Y., to Grant. The road is projected to extend from Chautauqua, N. Y., on the Jamestown & Lake Erie south about 18 miles to Brokenstraw on the Erie. (See this column for June 18, 1897.)

Portland, Vancouver & Yakima.—It is officially stated that the entire route of this road, which is the successor to the Vancouver, Klickitat & Yakima, is from Vancouver, Wash., northeast about 160 miles to North Yakima. Of this 15 miles is built and in operation. Surveys are now being made for an extension to the Yakima, but no contracts have yet been let. The company has from 40 to 50 men repairing the old road and building 1½ miles of spur with heavy timber. The character of the work to be done is comparatively easy with no bridges worth mentioning. The maximum grade will be 1½ per cent. and the maximum curvature 10 deg. The company expects to complete at least 30 miles of the extension in 1898, and to place bonds in the East for that purpose. James H. Hubbard, of Vancouver, Wash., is General Manager.

Queen Anne's.—It is reported that tracklaying has been completed into Lewes, Del., on this road from

Queenstown, Md., southeast to Lewes, on the Delaware Bay, 60 miles. There is a small section of road still to be built (contracts not let) to connect this line with the Pennsylvania, at Lewes, whence trackage rights have been secured to Rehoboth. (For a full description of this road with map see this column for Dec. 10.)

Rice Lake, Dallas & Menomonee.—It is officially stated that this company is negotiating for an extension of this road from Cameron, Wis., to Menomonee. The road, as originally projected, was to extend from Superior, Wis., to Menomonee, 40 miles, of which 7.32 miles from Rice Lake to Cameron has been completed.

Rio Grande, Sierra Madre & Pacific.—Gov. Miguel Ahumada and staff officially opened this road in the name of President Diaz of Mexico, on Jan. 19. This road was completed from Ciudad Juarez, Mex., opposite El Paso, Tex., southwest 157 miles to Casas Grandes about July 1. The company is organized under the State of New York and the road has been built by New York capitalists. Work was begun Oct. 1, 1896, and a government subsidy was received for 800,000 km. A. Foster Higgins, of New York, is President.

Spring Garden Connecting.—This company was incorporated in Pennsylvania, Jan. 24, with a capital stock of \$200,000. It is proposed to build a road from a point near the center of the northern line of Reserve Township, in Allegheny, Pa., and thence along Spring Garden Creek to the northern line of Allegheny City, Pa., and thence by the most favorable route to a connection with the Pennsylvania, and the line of the Pittsburgh & Western below the Thirtieth street bridge across the Allegheny River, with a branch to Vinal street in Allegheny. The total length is about 3 miles. The officers of the company are given in another column.

Terminal Railroad Association of St. Louis.—It is officially stated that location has been made for the West Belt Line contemplated by this company and that building depends upon the action of the City Council with reference to this line. The proposed route is from Carrie avenue northeast to a connection with the St. Louis & Suburban Railroad. Grading has been completed from Florissant avenue to Natural Bridge road. The maximum grade is one per cent.; maximum curvature 10 deg. There will be two 60-ft. plate girder bridges, and three highway crossings. E. P. Bryan, of St. Louis, Mo., is Vice-President and General Manager.

Toledo & Northwestern.—The Taylor Construction Company, of Owosso, Mich., has the contract for laying track on this road. The Maltby Lumber Company, of Bay City, Mich., furnishes the ties and timber and the Illinois Steel Company the rails. The road is projected to extend from Albion, Mich., north 24 miles through Duck Lake, Duttonville and Charlotte, a point on the Chicago & Grand Trunk. Most of the grading has been completed.

Uniontown, Waynesboro & West Virginia.—At a meeting of the County Commissioners of Marshall County, W. Va., Jan. 19, the officers of the county were authorized to issue bonds to the extent of \$100,000 in aid of this road, the incorporation of which was noted in these columns Dec. 31, the money to be expended in West Virginia. The County Commissioners of Ohio County met Jan. 21, and appointed a committee of three to secure the building of this road to Wheeling. Ohio County has offered to subscribe \$200,000 to secure the building of the road.

White Oaks & Kansas City.—This company has been incorporated in New Mexico, with a capital stock of \$4,000,000, to build a line from White Oaks, N. Mex., northwest about 250 miles to a point on the Texas State Line, where connection is to be made with a road of the same name, to be chartered under the laws of Texas. The incorporators are: J. A. Eddy, W. A. Hawkins, H. A. Connor, G. L. Christie and W. H. Austin. The directors are: C. D. Stimpson, Pennsylvania; B. S. Harmon, G. C. W. Lowry, New York; N. Y.; John A. Eddy, Denver, Colo.; C. B. Eddy, W. A. Hawkins, Max Frost, New Mexico. Some of these men are officers of the El Paso & Northeastern, now under construction from El Paso, Tex., northeast 165 miles to White Oaks, N. Mex. (See these columns for last week.)

Electric Railroad Construction.

Brockton, Mass.—The Brockton, Bridgewater & Taunton Street Railway Co. has applied for a franchise for the extension of its line from Bridgewater to New Bedford, the road to run through Titicut, North Middleboro and Lakeville.

Chicago, Ill.—The Wisconsin Inland Lakes & Chicago Railway Co. has been granted an ordinance by the Chicago City Council to lay tracks and erect poles. The plan is for an electric railroad between Chicago and Wisconsin summer resorts.

The Chicago Central Electric Co. has been granted a right of way in a number of miles more of streets. The Chicago City Railway has an ordinance before the City Council for the right to extend its tracks on a number of streets, work to commence in March.

Exeter, N. H.—It is reported that W. D. Lovell, of Exeter, is interested in a project to build an electric railroad connecting Exeter and Epping, N. H., and Amesbury, Mass.

Fanwood, N. J.—An electric railroad is talked of to run from Fanwood to Scotch Plains. T. J. Nichol, Chairman County Commissioners, can probably give information.

Holyoke, Mass.—It is stated that the Northampton Street Railway Co. and the Holyoke Street Railway Co. have each appointed a committee of their officers to investigate the practicability of building an electric road connecting Northampton and Holyoke. In 1895 the Western Hampshire Street Railway Co. received a charter to build and operate electric railroads in Williamsburg, Goshen, Chesterfield, Huntington, Cummington and Worthington. A railroad as at present talked of would run through some of these towns. Some of the men interested in the company chartered in 1895 are stockholders in the Northampton Street Railroad Co.

Joliet, Ill.—The Joliet City Railway Co. has been granted a 50-year franchise to run cars on several additional miles of street. The amount of money to be expended by the company in improvements is said to be \$200,000.

Kansas City, Mo.—The Kansas City, Lawrence & Topeka Electric Railroad & Power Co. (see *Railroad Gazette* Jan. 7) has organized with the following officers: E. P. Purcell, of Manhattan, Kan., President; John G. Johns, Secretary; Edward G. Anderson, of Kansas City, Kan., Assistant Secretary, and James Haggart, of Kansas City, Treasurer. The directors are Henry McGrew

and W. L. Wood, of Kansas City, Kan., and T. E. Holmes and A. H. Gossett, of Kansas City, Mo.

Montreal, Que.—The Montreal & Southern Counties Railway Co. expect to apply to Parliament next session for an act amending its act of incorporation for the purpose of increasing its capital stock and bonding power, issuing preferential stock and extending its line through the counties of Chateaugay, Huntington, Beauharnois and Napierville.

Mt. Washington, O.—A company, which will probably be known as the Linwood, Mt. Washington & Bethel Electric Railroad Co., proposes to connect points in Hamilton County. John B. Martin, of Linwood, is mentioned in connection with the enterprise.

Newton, Mass.—The Newtonville & Watertown Street Railway Co. has again asked the Railroad Commissioners for permission to extend its tracks into the city of Boston. A hearing on Jan. 21 was adjourned to Feb. 2 and it is probable the petition will be granted and the extension made.

New York, N. Y.—The King's Bridge Railway Co., capital stock \$1,000,000, has been incorporated to build 8½ miles of road with the following terminals: Manhattan street, at its intersection with the Boulevard; northernmost point of the intersection of King's Bridge Road or Broadway, and West 230th street; Riverdale avenue, at the northerly line of the City of New York, and the intersection of King's Bridge Road and Amsterdam avenue at or near 162d street. Directors include Henry Hart, Edward Lauterbach, Albert J. Elias, Charles Remsen and John Byrnes, of New York.

Niagara Falls, N. Y.—The Niagara Falls & Suspension Bridge Railway Co. has made application for a franchise for a cross-town route, to run from Ontario avenue at the north end of the city to Buffalo avenue, near the city line, where it will connect with the Buffalo & Niagara Falls Electric Railway.

Pasadena, Cal.—The Pasadena & Los Angeles Electric Railway Co. will make additions to its power equipment.

Providence, R. I.—Messrs. Tucker, Anthony & Co., of Boston, will finance a new road which will probably be called the Providence & Taunton Street Railway Co., to operate between the above centers, connecting with Union Railway Co., of Providence, and the Brockton, Bridgewater & Taunton Street Railway Co., at Taunton. The proposed capitalization is \$175,000 stock and \$175,000 bonds. Construction will commence in the spring. The road will be 14 miles in length and will make a direct road between the two cities. Mr. P. L. Saltonstall, of Boston, will probably be Treasurer.

Seattle, Wash.—The Seattle City Railway Co. has made application for an extension of its franchise to cover several miles of street.

Toledo, O.—It is stated that the Jacobson & Johnson Electric Railroad (see *Railroad Gazette* Feb. 19, 1897) between Toledo, O., and Monroe, Mich., will be built at once, and that contracts have been awarded Holt, Schorber & Co., of Philadelphia, Pa. P. N. Jacobson and William Johnson, of Detroit, Mich., and J. N. Bick, of Toledo, are interested.

Washington, D. C.—Among those interested in the Wesley Heights Railway Co. (see *Railroad Gazette* for Jan. 31) are Matthew C. Butler, Henry D. Fry, James H. G. Martin, John F. Wagemann and William E. Burford, of Washington.

Waukegan, Ill.—Preparations are under way for resuming work on the Bluff City Electric Street Railway.

GENERAL RAILROAD NEWS.

Railroad Earnings.

[Showing the gross and net earnings for the periods ending at the dates named.]

	1897.	1896.	Inc. or Dec.
November 30:			
Baltimore & Ohio.			
1 month..... Gross	\$2,254,712	\$2,183,216	I. \$71,496
1 "..... Net	604,180	473,302	I. 135,878
5 months..... Gross	11,626,964	11,335,517	I. 291,447
5 "..... Net	3,198,159	2,834,430	I. 363,729
Burlington, Cedar Rapids & Northern.			
1 month..... Gross	\$427,374	\$373,777	I. \$53,647
1 "..... Net	126,762	88,312	I. 38,420
Cleveland, Lorain & Wheeling.			
5 months..... Gross	\$632,698	\$510,644	I. \$122,054
5 "..... Net	215,707	110,376	I. 105,331
Grand Trunk.			
1 month..... Gross	\$1,832,635	\$1,612,509	I. \$220,126
1 "..... Net	645,876	438,252	I. 207,624
Santa Fe, Prescott & Phoenix.			
5 months..... Gross	\$301,566	\$234,081	I. \$67,485
5 "..... Net	168,161	119,438	I. 48,723
December 31:			
Buffalo & Susquehanna.			
6 months..... Gross	\$336,889	\$319,788	I. \$17,101
6 "..... Net	168,990	170,707	D. 1,717
Chesapeake & Ohio.			
1 month..... Gross	\$1,137,801	\$1,018,818	I. \$118,983
1 "..... Net	372,367	365,313	I. 7,054
6 months..... Gross	6,047,765	5,358,629	I. 689,136
6 "..... Net	2,033,013	1,870,669	I. 162,344
Chicago & Eastern Illinois.			
1 month..... Gross	\$445,368	\$389,006	I. \$56,362
1 "..... Net	213,491	188,977	I. 24,516
6 months..... Gross	2,222,315	2,007,717	I. 214,598
6 "..... Net	1,209,689	1,098,123	I. 111,566
Georgia Southern & Florida.			
6 months..... Gross	\$467,408	\$456,614	I. \$10,794
6 "..... Net	160,222	116,320	I. 43,902
Mobile & Ohio.			
6 months..... Gross	\$2,134,949	\$1,997,526	I. \$137,423
6 "..... Net	817,340	764,110	I. 53,230
New York, Susquehanna & Western.			
1 month..... Gross	\$239,953	\$203,815	I. \$36,138
1 "..... Net	118,542	97,069	I. 21,473
6 months..... Gross	1,357,043	1,239,623	I. 117,420
6 "..... Net	502,420	466,096	I. 36,324
Northern Central.			
1 month..... Gross	\$586,440	\$520,120	I. \$66,320
1 "..... Net	31,698	125,290	D. 93,592
12 months..... Gross	6,732,703	6,286,602	I. 446,101
12 "..... Net	1,934,536	1,643,497	I. 291,039
Reading Company.			
Railway Company.			
1 month..... Gross	\$1,947,585	\$1,739,241	I. \$208,344
1 "..... Net	872,229	797,814	I. 74,415
6 months..... Gross	11,886,184	11,217,561	I. 668,623
6 "..... Net	5,559,781	5,152,995	I. 406,786

Creal & Iron Company.				
1 month.....	Gross	\$2,024,933	\$1,770,638	I. \$254,299
1 ".....	Net	81,487	112,373	I. 92,869
6 months.....	Gross	13,382,282	12,367,429	I. 1,021,453
6 ".....	Net	813,122	731,435	I. 87,087
Both Companies:				
1 month.....	Net	\$979,939	\$808,766	I. \$171,193
6 months.....	Net	6,532,163	6,161,393	I. 497,773
* Deficit.				
Pittsburgh, Cincinnati, Chicago & St. Louis.				
1 month.....	Gross	\$1,527,536	\$1,233,445	I. \$297,161
1 ".....	Net	524,967	354,181	I. 170,786
Pittsburgh, Youngstown & Ashabula.				
1 month.....	Gross	\$113,149	\$69,891	I. \$43,258
1 ".....	Net	4,895	7,278	I. 12,173
12 months.....	Gross	1,462,716	1,383,101	I. 79,656
12 ".....	Net	521,339	435,094	I. 89,245
* Deficit.				
San Francisco & Northern Pacific.				
6 months.....	Gross	\$171,031	\$102,466	I. \$68,565
6 ".....	Net	204,492	156,011	I. 48,481
Southern.				
1 month.....	Gross	\$1,836,011	\$1,639,799	I. \$196,251
1 ".....	Net	611,059	583,283	I. 57,776
6 months.....	Gross	10,493,753	9,838,585	I. 655,170
6 ".....	Net	3,501,084	3,299,953	I. 201,731

Atlantic, Valdosta & Western.—The mortgage for \$2,500,000 to the Central Trust Company of New York was filed at Jacksonville, Fla., Jan. 15, to secure bonds issued for the purpose of completing the gap from Fort Moniac, Fla., west to the Suwannee River, 24 miles. The road when completed is to extend from Haylow, Ga., southeast 72 miles to Crawford, Fla. (See this column for Dec. 10.)

Central Ohio.—In reply to the application for a separate receivership, from the Baltimore & Ohio, for this company, denial is made that there has been any manipulation of its accounts in the interests of the Baltimore & Ohio, and the statement made that the road has been operated by the Baltimore & Ohio merely in compliance by order of the court. That separate accounts have been kept, and that if a receiver should be appointed there is no equipment with which to operate the road. (See this column for Jan. 14.)

Central Washington.—This road was sold under foreclosure, Jan. 19, at Spokane, Wash., by Master in Chancery W. J. J. Wakefield for \$100,000. (See this column for Dec. 10.) This road extends from Cheney, Wash., to Coulee, 108.3 miles. It was leased on its completion in 1891 to the Northern Pacific, but went into the hands of a Receiver in 1893, and the lease was cancelled two years later, the road being operated since that time by the Receiver. The road was bid in by the bondholders, and the committee expects to announce soon the plan of reorganization. The judgment against the property is for \$2,286,400.

Colorado Valley.—The Texas Railroad Commission has approved of the issue of \$45,000 first mortgage bonds by this company for five miles of its road from Sweetwater, Tex. The road is projected to run from Sweetwater southeast toward San Antonio and Austin. Irvine Wheatcroft, of Sweetwater, is Vice President and General Manager. (See these columns for Dec. 31.)

Duluth & Iron Range.—This company, on Jan. 16, filed amended articles of incorporation in Minnesota to increase its capital stock from three million to ten million dollars, and fixing the limit of debt above its secured liabilities at \$2,500,000. This is in accordance with the recent permit given by the Minnesota State Railroad and Warehouse Commission for the increase of stock to make improvements on this road. (See this column for Dec. 3.)

Fitchburg.—This company has asked the Railroad Commissioners of Massachusetts for authority to issue \$1,450,000 of 30-year 4 per cent. bonds, to be used in refunding \$550,000 of the Cheshire 6 per cent. bonds, maturing July, 1898; \$500,000 mortgage on the company's dock property to take up a floating debt of \$100,000.

Laurel Fork & Sand Hill.—This road was sold at auction at Parkersburg, W. Va., Jan. 17, to Stiles Bros. for \$3,200. The bidders were the heaviest holders against the road. This line extends from Laurel Fork Junction, W. Va., to Volcano, 3.5 miles.

Leavenworth, Kansas & Western.—Levy has been made on the real estate of this company, formerly the Kansas Central, to satisfy a deficiency judgment against the old company. When the road was sold on June 25, 1897, it did not bring within one and one-half million dollars of enough to satisfy the mortgage against the road, and the property levied will be sold at auction. (See this column for July 2.)

Mammoth Cave.—The sale of this road under judgment of the Barren Circuit Court, advertised to be conducted by Special Commissioner James M. Richardson, at the Court House door, in Glasgow, Ky., Jan. 17, has been postponed for 60 days. This road extends from Glasgow Junction, Ky., to Mammoth Cave, 8.33 miles. It was chartered in 1874, and opened Nov. 17, 1886, and has been operated by the Louisville & Nashville. It has a funded debt of \$100,000. A receiver was appointed Aug. 12, 1895.

Mexican Southeastern.—A bill has been filed by Nelson D. Parkhurst, in the Circuit Court of St. Louis, Mo., for a Receiver for this company. The complainant charges John D. MacLennan, of Cleveland, O., General Manager of the road, with delaying the completion of the section of 62 miles under the Mexican subsidy grant, causing the forfeiture of the concession. It is claimed that the company has debts growing out of the work of construction to the amount of about \$35,000. (For a description of this road, with map, see these columns for Dec. 24.)

Mobile & Ohio.—R. M. Quigley & Co., Contractors of St. Louis, Mo., filed a suit on Jan. 15 for about \$195,000. This company holds a sub-contract from the Hanover Construction Company for grading and for bridge and timber work on about 125 miles between Tuscaloosa and Montgomery, Ala. The complainant alleges conspiracy and fraud on the part of the Hanover Company, and claims a balance of \$195,000 on the contract.

New York & Ottawa.—It is reported that the Ontario government has granted a subsidy of \$35,000 to this company for the bridge across the St. Lawrence. (For the latest facts with reference to this company see this column for last week.)

Peoria, Decatur & Evansville.—Notice is given by the Brown Committee that second mortgage bonds and certificates of these bonds can be deposited under the reorganization plan, given in this column for Oct. 1, upon the payment of five per cent., the first installment of the assessment, with interest at six per cent.

on said assessment from Nov. 1. Of \$2,757,000 first mortgage bonds \$2,580,000 have been deposited under this bond.

Philadelphia & Reading.—Thirty 10-year sinking fund five per cent. coupon bonds of 1932 have been drawn for payment Feb. 1, at the office of the Pennsylvania company, for insurances on Lives and Granting Annuities, of Philadelphia.

Saluda Southern.—It is reported that the capital stock of this company, whose incorporation in Arizona was reported in these columns Oct. 8, is \$19,755,000 and that the incorporators are: P. R. Parker, F. L. Conkey, S. C. Symonds, Chas. Nissen, John Dolittle, C. H. Leonard, Phoenix, Arizona, and J. A. Walter, Germantown, Ky.

Seaboard & Roanoke.—Senator Daniel, of Virginia, has introduced a bill authorizing the Court of Claims to adjust the claim of the Seaboard & Roanoke Railroad Co., for the use of its property by the United States during the Civil War.

South & North Alabama.—J. A. Bullock, a stockholder of this company, has filed a bill in equity in the City Court at Montgomery, Ala., asking for a Receiver for this road on the ground that the Louisville & Nashville is rapidly absorbing to its own use the property of the South & North Alabama. Mr. Bullock asks that a reasonable rental value be ascertained for the use of this road by the Louisville & Nashville since 1873, and that the Louisville and Nashville be made to account for proceeds of bonds issued by the South & North Alabama, and for other relations. The South & North Alabama extends from Decatur, Ala., to Montgomery, 182.66 miles, and from Elmore to Wetumpka, Ala., 6.3 miles. The Louisville & Nashville owns a controlling interest in the capital stock and guarantees the first mortgage bonds and five per cent. consols.

Southern.—A meeting of the stockholders has been called at the city of Richmond, Va., Feb. 18, at 10 a. m., for the purpose of approving of the action heretofore taken and of authorizing future action for the acquisition of the whole or any part of the Memphis & Charleston, and for the issue and sale of bonds and capital stock of the Southern in payment of the four properties of this road. The Memphis & Charleston extends from Memphis, Tenn., to Stevenson, Ala., 272 miles, with a branch 14 miles to Moscow and Summerville, Tenn., and another branch of six miles from Tusculia to Florence, Ala. This company was formerly controlled by the East Tennessee & Georgia, but was excluded from the modified plan of the Richmond & West Point Terminal Company in February, 1894. Foreclosure proceedings were begun in July, 1896, and on Feb. 11, 1897, a decree was issued ordering the sale of the road, but an appeal from this decision has been granted and the case is still pending.

Union Pacific.—Senator Thurston has introduced in the U. S. Senate an amendment to the bill authorizing the Secretary of the Treasury to purchase the Kansas Pacific Division of the Union Pacific. The amendment provides that in case the government purchases any part of the road the President of the United States may, in his discretion, sell all the property thus purchased for a sum not less than the full amount paid out by the United States to redeem it. A bill was presented in the House of Representatives by Congressman Fleming, of Georgia, authorizing the Secretary of the Treasury under certain conditions to purchase the Kansas Pacific Division of the Union Pacific.

Judge Lacombe, of the United States Circuit Court, has had down a decision denying the application of Josiah B. French and others for relief in the foreclosure suit brought by J. P. Morgan and others as trustees under the collateral trust debt of 1891.

Utah Central.—Judge Hiles, of St. Louis, Mo., on Jan. 15, approved the report of George D. Loomis, Receiver and Special Master of the old Utah Central, and the Receiver was discharged. This road came into possession of the Rio Grande Western Dec. 17 upon the payment of \$550,000 in bonds. (See this column for Oct. 1.)

Wisconsin & Michigan.—It is reported that this company will issue bonds for about \$575,000, for an extension of the road to Menominee Iron Range and new timber belt to the north. J. M. Fischer, of Chicago, Ill., is President.

Electric Railroad News.

Atlanta, Ga.—The Atlanta Consolidated Street Railway Co. has elected Ernest Woodruff President to fill the place formerly held by Joel Hurt.

Braintree, Mass.—The Braintree Street Railway Co. has petitioned the Railroad Commissioners for authority to increase its capital stock from \$75,000 to \$110,000.

Brooklyn, N. Y.—An informal trial trip of the electric road just completed across the Brooklyn Bridge was made on the morning of Jan. 22. Two of the parlor cars of the Brooklyn Heights Railroad, President Johnson's private car of the Nassau Electric Railroad and one of the cars of the Coney Island & Brooklyn Railroad started from the City Hall at 10:40 o'clock, and made the trip across on the north side and returned on the south roadway of the bridge. The guests included several of the prominent city officials and the officers and directors of the roads named. The trip proved that both the roadway and the overhead construction was ready for the regular running of cars, but this will not be done until the roadway has been widened. The cars of one of the lines was, however, run over the bridge the following day (Jan. 23) during the slack hours, and this will be done to a limited extent until all the work has been completed and the cars are all placed in regular service.

Chicago, Ill.—Mr. George O. Nagle, formerly Assistant Superintendent, has been appointed General Superintendent of the Chicago City Railway, succeeding Mr. M. K. Bowen, lately made President. Mr. A. C. Heidelberg, formerly Second Assistant Superintendent, will succeed Mr. Nagle.

Holland, Mich.—The Holland & Lake Michigan Electric Railroad has recently been reorganized. H. B. Black, President, and I. E. Cochran, Jr., Secretary.

New Orleans, La.—At the annual election of the New Orleans & Carrollton Railroad Co., Mr. Jacob Newman was elected President, Major W. B. Crouch, Secretary, and George H. Davis, General Manager.

Ottawa, Ill.—Ex-Mayor L. W. Hess has been appointed Receiver of the Ottawa Street Railway Co., and will have charge of the operation. The company was chartered in December, 1896, and purchased the Ottawa Electric Street Railway. It operates eight motor cars and four trailers. The road will be operated by the Receiver.

Wheeling, W. Va.—At a meeting of the stockholders of the Wheeling & Elm Grove Railroad Co., of Wheeling, W. Va., an issue of \$225,000 five per cent. gold bonds was authorized to pay for changing the motive power from steam to electricity, rebuilding the suburban portion of the line and to make other improvements. The stockholders also authorized the purchase of the property of the Suburban Railway Co. This will give the Wheeling & Elm Grove a continuous electric line, eight miles in length from the business center of Wheeling to Triadelphia, and a franchise over the National Pike from Wheeling to the Pennsylvania State line, 23 miles.

TRAFFIC.

Traffic Notes.

The railroads of Texas are giving free passes for an annual reunion to members of the Texas Veterans' Association. The courtesy is limited, however, to those who served in the army of Texas prior to the year 1837.

Rates on bituminous coal to the Atlantic seaboard have been the subject of arbitration, the arbitrators being Hon. Adlai E. Stevenson, ex-Vice President of the United States; Mr. J. T. Goddard and J. T. Harahan.

The suit of Charles M. Despeaux, of France, against the Pennsylvania Railroad, for alleged overcharges on oil 15 years ago, has been thrown out of court, Judge Dallas declaring that the evidence was insufficient to justify a suit.

The steamships from Puget Sound to Alaska have advanced freight rates 30 per cent.; first class passenger rates 25 per cent., and second class 40 per cent. Business is so brisk that every vessel on the Pacific coast that can be made serviceable is being used for this traffic.

Movements on the part of wholesale merchants in large cities to provide specific financial inducements to attract country buyers are becoming somewhat common. In St. Louis, large drygoods houses have combined to offer Texas buyers a discount on cotton goods, enough to neutralize alleged discounts in freight rates from New York. The Kansas City Transportation Bureau has sent out circulars offering reimbursement for railroad fares, limited, however, to an amount equal to 2 per cent. on the purchases made. The railroads from St. Louis to the Southwest have reduced the rate to Texas on cotton piece goods to 70 cents.

The Railroad Commissioners of Alabama have denied the application of certain railroads for leave to increase freight rates on less than carload lots, so as to make the differential between C. L. and L. C. L. rates on goods classed in classes B, C, D, and F, eight cents instead of four. The Commissioners in their decision say that the proposed rates would discriminate against small shippers in favor of large, and divert a large amount of business to other states that legitimately belong to Alabama. They say that the railroads, according to their last annual report, did a "fairly remunerative business," while the people of the state—the railroad's customers—are "embarrassingly reduced in resources." To raise the rates to small traders would therefore be killing the goose that lays the golden egg.

Cattle Exports.

The exports of cattle from all ports of the United States for the calendar year 1897 amounted to 395,000 head, an increase of about 30,000 over 1896. The largest movement was through Boston, 154,406 head. New York exported 135,155, Baltimore 58,003 and Philadelphia 18,632. The shipments by the different lines from New York, as reported in the *Journal of Commerce*, were as follows:

White Star Line.....	42,000
Wilson and Wilsons & Furness-Layland Lines.....	39,300
Atlantic Transport and National Lines.....	34,000
Allan State Line.....	10,000
James Arkell & Co.....	7,500

Chicago Traffic Matters.

CHICAGO, Jan. 26, 1898.

The Western Passenger Association has started a vigorous fight against the scalpers of this city for dealing in non-transferable transportation, and the Grand Jury has already indicted nine of the brokers on evidence collected by the agents of Chairman Caldwell.

It is charged that the lines running west from St. Paul are cutting passenger rates on Klondike business. It is said that the Kansas City, Pittsburgh & Gulf is making serious inroads into the export grain business of the lines leading direct to the North Atlantic ports via Chicago.

The complications which arose and bid fair to disrupt the recently created steamship agreement of the Western roads have been adjusted, all agents having agreed to co-operate in the routing of immigrant traffic turned over to them by the trans-Atlantic steamship companies.

The roads leading into Chicago from the Northwest are said to be getting little or none of the flour traffic from Minneapolis. Under existing rates the cross-lake lines are taking all the business.

Grain rates, eastbound, which have stood firm since the first of the year, have now got shaky and one road, the Pennsylvania, is positively asserted to be cutting the rate from two to three cents below tariff.

The Western lines have agreed to make the same reduced rates from their territory to New Orleans for the Mardi Gras festival as they did last year, one fare for the round trip.

Texas passenger rates are demoralized, the trouble being laid at the doors of the Missouri, Kansas & Texas and the Kansas City, Pittsburgh & Gulf, which are accused of carrying passengers at any rates obtainable.

Eastbound shipments from Chicago and Chicago junctions to points at and beyond the Western termini of the trunk lines for the week ending Jan. 20 amounted to 100,361 tons, as compared with 118,067 tons the preceding week. This statement includes 53,138 tons of grain, 9,279 tons of flour and 11,759 tons of provisions, but not live stock. The following is the statement in detail for the two weeks:

Roads.	WEEK ENDING Jan. 20.		WEEK ENDING Jan. 13.	
	Tons.	p. c.	Tons.	p. c.
Baltimore & Ohio.....	8,976	8.9	10,878	9.2
C. C. & St. Louis.....	4,111	4.1	4,926	4.2
Erie.....	11,178	11.1	11,323	9.6
Grand Trunk.....	12,772	12.7	16,376	13.9
L. S. & M. S.....	15,483	15.4	12,776	10.8
Michigan Central.....	12,412	12.4	9,312	8.4
N. Y., Chi. & St. L.....	9,053	9.0	8,951	7.6
Pitts., Cin., Chi. & St. Louis.....	10,920	10.9	11,344	9.8
Pitts., Ft. Wayne & Chicago.....	12,837	12.8	23,682	20.0
Wabash.....	2,659	2.7	7,689	6.5
Totals.....	100,361	100.0	118,067	100.0